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Superfund Technical Assessment & Response Team V  
EPA CONTRACT 68HE0319D0004

December 5, 2019

Mr. Peter Lisichenko, On-Scene Coordinator  
U.S. Environmental Protection Agency, Region II  
Superfund and Emergency Management Division  
2890 Woodbridge Avenue  
Edison, NJ 08837

**EPA CONTRACT No: 68HE0319D0004**

**TD No: TO-0032-0033**

**DC No: STARTV-01-D-0098**

**SUBJECT: SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN  
NIAGARA FALLS BOULEVARD SITE,  
NIAGARA FALLS BOULEVARD, NIAGARA COUNTY, NEW YORK**

Dear Mr. Lisichenko,

Enclosed please find the Site-Specific Uniform Federal Policy (UFP) Quality Assurance Project Plan for the sampling activities to be conducted as part of the Removal Action at the Niagara Falls Boulevard Site (the Site) located in Niagara Falls, Niagara County, New York. This plan covers the soil and concrete sampling activities to be performed at the Site beginning October 14, 2019.

If you have any questions, please do not hesitate to call me at (732) 585-4413.

Sincerely,

WESTON SOLUTIONS, INC.

Bernard Nwosu  
START V Site Project Manager

Enclosure:  
cc: TD File: TO-0032-0033

*an employee-owned company*



In association with Eco-Risk, Pro-West & Associates, Inc., Avatar Environmental, LLC,  
On-Site Environmental, Inc., and Sovereign Consulting, Inc.

# **SITE-SPECIFIC UFP QUALITY ASSURANCE PROJECT PLAN**

## **NIAGARA FALLS BOULEVARD SITE**

Niagara Falls, Niagara County, New York

SSID No.: A23Q

EPA ID No.: NYN000206699

Prepared by:

Superfund Technical Assessment & Response Team V  
Weston Solutions, Inc.  
Federal East Division  
Edison, New Jersey 08837

Prepared for:

U.S. Environmental Protection Agency, Region II  
Superfund and Emergency Management Division  
2890 Woodbridge Avenue  
Edison, New Jersey 08837

DC No: STARTV-01-D-0098

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December 2019

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## LIST OF ATTACHMENTS

**Attachment A** – Figure 1: Site Location Map

**Attachment B** – ERT/SERAS SOP # 2001 – *General Field Sampling Guidelines*  
ERT/SERAS SOP # 2012 – *Soil Sampling*

## LIST OF ACRONYMS

ADR	Automated Data Review
ANSETS	Analytical Services Tracking System
AOC	Acknowledgment of Completion
ASTM	American Society for Testing and Materials
CEO	Chief Executive Officer
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP	Contract Laboratory Program
CFM	Contract Financial Manager
CO	Contract Officer
COI	Conflict of Interest
COO	Chief Operations Officer
CRDL	Contract Required Detection Limit
CRTL	Core Response Team Leader
CRQL	Contract Required Quantitation Limit
CQLOSS	Corporate Quality Leadership and Operations Support Services
CWA	Clean Water Act
DCN	Document Control Number
DI	Deionized Water
DPO	Deputy Project Officer
DQI	Data Quality Indicator
DQO	Data Quality Objective
EM	Equipment Manager
EDD	Electronic Data deliverable
ENVL	Environmental Unit Leader
EPA	Environmental Protection Agency
ERT	Environmental Response Team
FASTAC	Field and Analytical Services Teaming Advisory Committee
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
HASP	Health and Safety Plan
HRS	Hazard Ranking System
HSO	Health and Safety Officer
ITM	Information Technology Manager
LSASD	Laboratory Services and Applied Science Division
LEL	Lower Explosive Limit
MSA	Mine Safety Appliances
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration

### **LIST OF ACRONYMS (Concluded)**

OSWER	Office of Solid Waste and Emergency Response
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability, Sensitivity
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PIO	Public Information Officer
PM	Program Manager
PO	Project Officer
PRP	Potentially Responsible Party
PT	Proficiency Testing
QA	Quality Assurance
QAL	Quality Assurance Leader
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RC	Readiness Coordinator
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
RSCC	Regional Sample Control Coordinator
RST	Removal Support Team
SARA	Superfund Amendments and Reauthorization Act
SEDD	Staged Electronic Data Deliverable
SOP	Standard Operating Practice
SOW	Statement of Work
SPM	Site Project Manager
START	Superfund Technical Assessment & Response Team
STR	Sampling Trip Report
TAL	Target Analyte List
TCL	Total Compound List
TD	Technical Direction
TDL	Technical Direction Letter
TO	Task Order
TQM	Total Quality Management
TSCA	Toxic Substances Control Act
UFP	Uniform Federal Policy
VOA	Volatile Organic Analysis

**TABLE 1 — Crosswalk**

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
A. Project Management and Objectives			
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7, & 8	Personnel Qualifications and Sign-Off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certifications
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model (CSM)	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP ELEMENTS FOR EVALUATING EXISTING DATA
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
B. Measurement/Data Acquisition			
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field Quality Control (QC) Sample Summary	2.3.5	QC Requirements
21	Field Standard Operating Procedures (SOPs)	2.3.2	Sampling Procedures and Requirements

**TABLE 1 — Crosswalk (Concluded)**

Optimized UFP-QAPP Worksheets		2106-G-05 QAPP Guidance Section	
B. Measurement/Data Acquisition			
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical QC and Corrective Action	2.3.5	QC Requirements
29	Project Documents and Records	2.2.8	Document and Records Requirements
C. Assessment/Oversight			
31, 32, & 33	Assessments and Corrective Action	2.4	ASSESSMENTS AND DATA REVIEW (CHECK)
		2.5.5	Reports to Management
D. Data Review			
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

## QAPP Worksheet #1 & 2: Title and Approval Page


### 1. Project Identifying Information

- a) **Site Name/Project Name:** Niagara Falls Boulevard Site  
b) **Site Location/No.:** Niagara Falls, Niagara County, New York/ NYN000206699  
c) **Contract/Work Assignment No.:** 68HE0319D0004/ TD#: 0032-0033

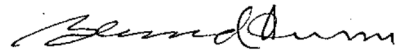
### 2. Lead Organization

Weston Solutions, Inc.  
1090 King Georges Post Road, Suite 201  
Edison, New Jersey 08837

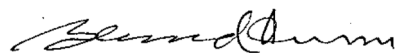
#### Lead Organization's Site Project Manager:

<u>Bernard Nwosu</u>	<u></u>	<u>12/05/2019</u>
Printed Name/Title	Signature	Date

#### Lead Organization's Technical Review:

<u>Bernard Nwosu</u>	<u></u>	<u>12/05/2019</u>
Printed Name/Title	Signature	Date

#### Lead Organization's QA/QC Chemist:

<u>For Smita Sumbaly</u>	<u></u>	<u>12/05/2019</u>
Printed Name/Title	Signature	Date

#### EPA Region II On-Scene Coordinator:

<u></u>	<u></u>	<u></u>
Printed Name/Title	Signature	Date

#### EPA Region II Quality Assurance Officer:

<u></u>	<u></u>	<u></u>
Printed Name/Title	Signature	Date

Document Control Number: STARTV-01-D-0098

**QAPP Worksheet #1& 2: Title and Approval Page (Concluded)**

**3. List Plans and reports from previous investigation relevant to this project.**

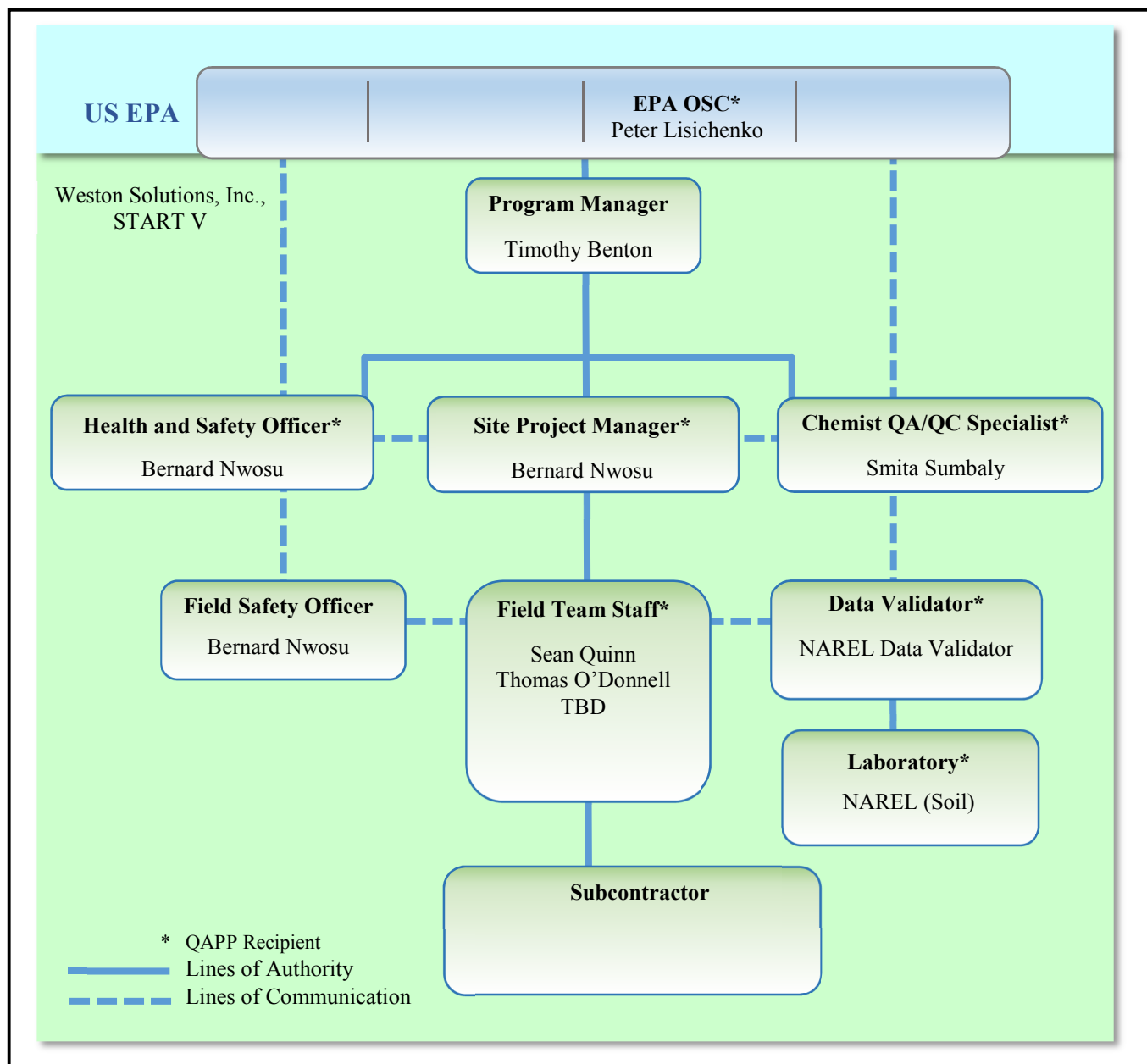
08/06/2015 – Draft Site-Specific UFP Quality Assurance Project Plan, August 6, 2015, DCN#: RST3-02-D-0033

02/25/2016 - Site-Specific UFP Quality Assurance Project Plan, February 25, 2016, DCN#: RST3-02-D-0208

**Exclusions:**

Not Applicable.

### QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution



#### Acronyms:

EPA – U.S. Environmental Protection Agency  
QA/QC – Quality Assurance/Quality Control  
START V – Superfund Technical Assistance & Response Team V  
OSC – On-Scene Coordinator  
NAREL – National Analytical Radiation Environmental Laboratory

### QAPP Worksheet #3 & 5: Project Organizational and QAPP Distribution (Concluded)

QAPP Recipient	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Peter Lisichenko	OSC	EPA, Region II	(347) 276-6251	NA	<a href="mailto:lisichenko.peter@epa.gov">lisichenko.peter@epa.gov</a>	STARTV-01-D-0098
Bernard Nwosu	SPM/HSO	Weston Solutions, Inc., START V	(732) 585-4413	NA	<a href="mailto:Ben.Nwosu@WestonSolutions.com">Ben.Nwosu@WestonSolutions.com</a>	STARTV-01-D-0098
Sean Quinn	Field Personnel	Weston Solutions, Inc., START V	(732) 425-1175	NA	<a href="mailto:Sean.Quinn@WestonSolutions.com">Sean.Quinn@WestonSolutions.com</a>	STARTV-01-D-0098
Thomas O'Donnell	Field Personnel	Weston Solutions, Inc., START V	(908) 565-2985	NA	<a href="mailto:Thomas.ODonnell@WestonSolutions.com">Thomas.ODonnell@WestonSolutions.com</a>	STARTV-01-D-0098
TBD	Field Personnel	Weston Solutions, Inc., START V	(732) 585-4447	NA	NA	NA
Smita Sumbaly	QAO	Weston Solutions, Inc., START V	(732) 585-4410	NA	<a href="mailto:S.Sumbaly@WestonSolutions.com">S.Sumbaly@WestonSolutions.com</a>	STARTV-01-D-0098
Site TD File	START V Site TD File	Weston Solutions, Inc., START V	Not Applicable	NA	NA	-

EPA – U.S. Environmental Protection Agency  
 OSC – On-Scene Coordinator  
 SPM – Site Project Manager  
 START V – Superfund Technical Assistance & Response Team V  
 QAO – Quality Assurance Officer  
 HSO – Health & Safety Officer  
 NA – Not Applicable  
 TBD – To be determined

### QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet

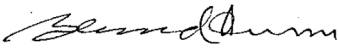


Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates <sup>1</sup>	Date of Training
<b>[Specify location of training records and certificates for samplers]</b>							
QAPP Training	This training is presented to all START V personnel to introduce the provisions, requirements, and responsibilities detailed in the UFP QAPP. The training presents the relationship between the site-specific QAPPs, SOPs, work plans, and the Generic QAPP. QAPP refresher training will be presented to all employees following a major QAPP revision.	Weston Solutions, Inc., (In House Training)	As needed	All START V field personnel upon initial employment and as refresher training	Weston Solutions, Inc.	Within Division	February 2019
Health & Safety Training	Health and safety training will be provided to ensure compliance with Occupational Safety and Health Administration (OSHA) as established in 29 CFR 1910.120.	Weston Solutions, Inc., (In House Training)	Yearly at a minimum	All Employees upon initial employment and as refresher training every year	Weston Solutions, Inc.	Within Division	February 2019
Others	Scribe, ICS 100 and 200, and Air Monitoring Equipment Trainings provided to all employees	EPA ERT (In-House Training) FEMA (On-line Training) Weston Solutions, Inc., (In House training)	Upon initial employment and as needed				February 2019
	Dangerous Goods Shipping	Weston Solutions, Inc., (In House Training)	Every 3 years				April 2019

All team members are trained in the concepts and procedures in recognizing opportunities for continual improvement, and the approaches required to improve procedures while maintaining conformance with legal, technical, and contractual obligations.

<sup>1</sup>All members, including subcontractors, certifications are in possession of Health & Safety Officer.

### QAPP Worksheet #4, 7 & 8: Personnel Qualification and Sign-off Sheet

#### Organization: Weston Solutions, Inc., START V

Name	Project Title/Role	Education and Experience Qualifications	Specialized Training/Certifications	Organizational Affiliation	Signature	Date
Bernard Nwosu	SPM/HSO, START V	25+ years*	SPM, Field HSO, Sample Collection and Sample Management	Weston Solutions, Inc.		12/05/2019
Sean Quinn	Field Personnel, START V	1+ years*	Sample Collection/Sample Management	Weston Solutions, Inc.		12/05/2019
Thomas O'Donnell	Field Personnel, START V	1 year*	Sample Collection/Sample Management	Weston Solutions, Inc.		12/05/2019
Smita Sumbaly	QAO, START V	30 years*	Chemist QA/QC Specialist	Weston Solutions, Inc.		

\*All START V members, including subcontractor's resumes are in possession of START V Program Manager, EPA Project Officer, and Contracting officers.

SPM – Site Project Manager

START V – Superfund Technical Assistance & Response Team V

QAO – Quality Assurance Officer

HSO – Health & Safety Officer

#### Organization: EPA Region II

Name	Project Title/Role	Education and Experience Qualifications	Specialized Training/Certifications	Organizational Affiliation	Signature	Date
Peter Lisichenko	EPA OSC	NA	All project coordination, direction and decision making.	EPA, Region II		

EPA – U.S. Environmental Protection Agency

OSC – On-Scene Coordinator

### QAPP Worksheet #6: Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Point of contact with EPA OSC	SPM, Weston Solutions, Inc., START V	Bernard Nwosu	(732) 585-4413	All technical, QA and decision-making matters in regard to the project (verbal, written or electronic)
Adjustments to QAPP	SPM, Weston Solutions, Inc., START V	Bernard Nwosu	(732) 585-4413	QAPP approval dialogue
Health and Safety On-Site Meeting	HSO, Weston Solutions, Inc., START V	Bernard Nwosu	(732) 585-4413	Explain Site hazards, personnel protective equipment, hospital location, etc.
Lab Data Quality Issues (including sample receipt variances and laboratory quality control variances)	Project Manager NAREL Project Manager	Tonya Hudson	(334) 270-3433	Laboratory PMs will report any issues with project samples to the WESTON Chemist QA/QC Specialist within 1 business day of notification. The WESTON Chemist QA/QC Specialist will contact the field sampler if necessary to resolve sample receiving discrepancies.
Data verification and data validation issues	WESTON Data Validator WESTON CHP/Data Validator	Smita Sumbaly	(732) 585-4410	The WESTON Data Validators/CHP will review the data verification and validation.
Analytical Corrective Actions	WESTON Chemist QA/QC Specialist Project Manager NAREL Project Manager	Smita Sumbaly  Tonya Hudson	(732) 585-4410  (334) 270-3433	If laboratory corrective actions are necessary, the WESTON Chemist QA/QC Specialist will communicate with the NAREL laboratory PM.
Data Tracking and Management, Release of Analytical Data	WESTON Chemist QA/QC Specialist WESTON SPM, Operations Manager	Smita Sumbaly  Bernard Nwosu	(732) 585-4410  (732) 585-4413	The need for corrective actions will be determined by the SPM upon review of the data. No analytical data will be released prior to validation and all releases must be approved by the Chemist QA/QC Specialist, SPM and EPA OSC/TM.

OSC: On-Scene Coordinator  
SPM: Site Project Manager  
HSO: Health and Safety Officer  
QA/QC: Quality Assurance/Quality Control  
START V: Superfund Technical Assistance & Response Team V  
NAREL: National Analytical Radiation Environmental Laboratory  
CHP: Certified Health Physicist

## QAPP Worksheet #9: Project Planning Session Summary

<b>Date of Planning Session:</b> 10/07/2019				
<b>Location:</b> Telephone Conversation				
<b>Purpose:</b> Scoping meeting for UFP-QAPP for EPA Region II START V				
Name	Title	Affiliation	E-mail Address	Phone No.
Peter Lisichenko	OSC	EPA, Region II	<a href="mailto:lisichenko.peter@epa.gov">lisichenko.peter@epa.gov</a>	(347) 276-6251
Bernard Nwosu	SPM	Weston Solutions, Inc., START V	<a href="mailto:Ben.Nwosu@westonsolutions.com">Ben.Nwosu@westonsolutions.com</a>	(732) 585-4413

### Site-Specific Initial Scoping Meeting Notes/Comments:

As part of the Removal Action activities at the Niagara Falls Boulevard Site (the Site), Weston Solutions, Inc., Superfund Technical Assessment & Response Team V (START V) has been tasked by the U.S. Environmental Protection Agency, Region II (EPA) with providing sampling support for the collection of up to 500 post-excavation soil samples and up to 100 concrete samples from the Site. Post-excavation soil samples will be collected from excavated areas of concern (AOCs) to verify that the concentrations of target radionuclides are below the EPA Site-Specific Action Levels. Utilizing dedicated plastic scoops, post-excavation soil samples will be collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 square feet (sq. ft.). Concrete samples will be collected to determine whether on-site concrete material can be repurposed for site restoration or if they need to be disposed of. Concrete samples will be collected from locations selected by the EPA On-Scene Coordinator (OSC). Field duplicates and additional sample volumes for matrix spike/matrix spike duplicate (MS/MSD) analysis will be collected at a frequency of one per 20 field samples per matrix. Rinsate samples will not be collected since dedicated sampling equipment will be utilized. In order to prevent excavated AOCs from remaining open for extended periods before backfilling, the soil samples collected from the various AOCs will be screened on-site using High Purity Germanium (HPGe) detector to perform quantitative gamma spectrometry analysis to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed to allow for the excavations to be backfilled with clean, pre-analyzed fill material. Following field screening, the samples will then be submitting for laboratory analysis. All the samples will be collected for definitive data and quality assurance/quality control (QA/QC) purposes, and analyzed by EPA's National Analytical Radiation Environmental Laboratory (NAREL). All samples will be analyzed for isotopic thorium, isotopic uranium, radium-226 (in-growth), radium-228, and other gamma emitting radioisotopes.

### Consensus Decision:

The Removal Action sampling activities are scheduled to being on October 14, 2019. All samples, including soil and concrete, will be submitted to NAREL for analyses. Analytical results of the soil samples will be compared against the EPA Site-Specific Action Levels.

### QAPP Worksheet #9: Project Planning Session Summary (Concluded)

#### Action Items:

Action	Responsible Party	Due Date
Prepare CLP Analytical Request Form	SPM, START V	Not Applicable
Prepare START V Analytical Request Form	SPM, START V	Not Applicable
Develop Health and Safety Plan	SPM, START V	10/11/2019
Develop QAPP	SPM, START V	12/5/2019
Develop Work Plan (driller, sampler, survey, etc.)	SPM, START V	Not Applicable
Develop Equipment List	SPM, START V	10/10/2019
Develop Site-Specific Data Management Plan	SPM, START V	10/10/2019

## **QAPP Worksheet #10: Conceptual Site Model**

### **Background Information:**

The Site is located in a mixed commercial and residential area of Niagara Falls, New York. The Site consists of two parcels, namely 9524 and 9540 Niagara Falls Boulevard and it encompasses approximately 2.53 acres. Currently, the 9524 Niagara Falls Boulevard property contains a bowling alley and an asphalt parking lot; the 9540 Niagara Falls Boulevard property is occupied by a hardware store, Greater Niagara Building Center, Inc. (GNBC) and an asphalt parking lot. The properties are bordered to the north by a wooded area; to the east by a church; to the south by Niagara Falls Boulevard, beyond which is a residential area; and to the west by a hotel and residential area.

In 1978, the U.S. Department of Energy (DOE) conducted an aerial radiological survey of the Niagara Falls region and identified more than 15 properties having elevated levels of radiation above background levels. It is believed that, in the early 1960s, slag from an unknown source was used as fill on the properties prior to paving. Based on the original survey and subsequent investigations, it is believed that the radioactive slag was deposited on the Site.

In September/October 2006 and May 2007, the New York State Department of Environmental Conservation (NYSDEC) conducted radiological surveys of the interior and exterior of both properties on several occasions using gamma detectors, Exploranium-135, and Ludlum Model 2221 Ratemeter/Scaler (Ludlum-2221). With the exception of an office area and storage space at 9540 Niagara Falls Boulevard that was constructed after the original building directly on top of the asphalt parking lot, interior radiation levels obtained with Exploranium-135 were relatively low. The highest reading in the newer area was 115 microrentgen per hour ( $\mu\text{R/hr}$ ); elsewhere throughout the building, radiation levels generally ranged between 10 and 20  $\mu\text{R/hr}$ . Exterior readings taken at waist height generally ranged between 10 and 350  $\mu\text{R/hr}$ , while the maximum reading of 600  $\mu\text{R/hr}$  was recorded at contact (i.e., at the ground surface). At a fenced area behind the building located at 9540 Niagara Falls Boulevard, waist-high readings ranged between 200 and 450  $\mu\text{R/hr}$ , and at-contact readings ranged between 450 and 750  $\mu\text{R/hr}$ . Elevated readings were also observed on the swath of grass between the 9524 Niagara Falls Boulevard property and the adjacent property to the west that contains a hotel, and in the marshy area beyond the parking lot behind the buildings. Two biased samples of slag were collected from locations that exhibited elevated static Ludlum-2221 readings: one slag sample collected from an area of loose blacktop indicated a reading of 515,905 counts per minute (cpm) and the second slag sample collected in the marshy area indicated a reading of 728,235 cpm.

During a reconnaissance performed by the New York State Department of Health (NYSDOH) and NYSDEC on July 9, 2013, screening activities with a hand-held pressurized ion chamber (PIC) unit around an area of broken asphalt indicated gamma radiation levels at 200  $\mu\text{R/hr}$  and 500  $\mu\text{R/hr}$  from a soil pile containing slag at the Site. Readings over 600,000 cpm were recorded with a sodium iodide scintillator from the soil and slag pile.

On September 10, 2013, the U.S. Environmental Protection Agency (EPA) and Weston Solutions Inc., Site Assessment Team (SAT), conducted gamma radiation screening of the 9524 Niagara Falls Boulevard property using Ludlum-2221. On December 4 through 7, 2013, further radiological survey information was obtained from the 9524 and 9540 Niagara Falls Boulevard

### **QAPP Worksheet #10: Conceptual Site Model (Continued)**

properties, as well as the church property located further east of the two site parcels. The highest gamma radiation screening results were recorded from the exposed soil area in the rear northern portion of the 9540 Niagara Falls Boulevard property. SAT documented and delineated the areas of observed contamination at the Site by measuring the gamma exposure rates and determining where the gamma exposure rate around the source equaled or exceeded two times (2x) the site-specific background gamma exposure rates. An area of the Site, approximately 168,832 square feet (sq. ft.), indicated gamma radiation levels exceeding 2x the background measurement of 8,391 cpm.

In December 2013, SAT utilized the hollow-stem auger drilling method to collect a total of 16 soil samples, including one field duplicate, and three slag samples from 15 boreholes advanced throughout the Site and on the First Assembly Church property. The two soil samples collected on the First Assembly Church property were to document background conditions. At each sample location, soil samples were collected directly beneath slag; at locations where slag was not present, the soil sample was collected at the equivalent depth interval. Laboratory analytical results indicated concentrations of radionuclides found in the slag and soil samples to be significantly higher than at background condition.

In July 2015, EPA with the support of Weston Solutions Inc., Removal Support Team 3 (RST 3), currently Superfund Technical Assessment & Response Team V (START V), conducted a Removal Assessment of the Site in order to delineate areas of observed contamination by comparing gamma measurements from suspected source areas with measurements obtained from a background location. Interior ground radiological survey of on-site properties, including 9524 Niagara Falls Boulevard and 9540 Niagara Falls Boulevard, and exterior ground radiological survey of the Site and an off-site background location at the church property on 9750 Niagara Falls Boulevard was conducted. Utilizing a Ludlum-2241 Ratemeter/Scaler and a sodium iodide (NaI) 2x2 detector, gamma measurements collected by RST 3 in the one building at 9524 Niagara Falls Boulevard indicated exposure rates ranging from 6,400 cpm around the pin setter area to 45,000 cpm (more than 5x above background) in the rear vestibule. Gamma exposure rates in most areas of the building at 9524 Niagara Falls Boulevard were generally above background. Gamma readings in the one building at 9540 Niagara Falls Boulevard ranged from 6,200 cpm in the showroom to 200,000 cpm (more than 23x above background) in one storage room located southwest of the building. Generally, gamma exposure rates in most areas of the building at 9540 Niagara Falls Boulevard varied from background to several times above the background. Gamma survey conducted in exterior areas throughout the Site, including asphalt-paved and unpaved areas of both 9524 Niagara Falls Boulevard and 9540 Niagara Falls Boulevard, indicated exposure rates ranging from 10,500 cpm to 600,000 cpm (more than 70x above background). Outdoor gamma readings were generally more than 2x background.

In August 2015, RST 3 conducted additional Removal Assessment soil sampling and radiological survey of exterior locations in order to verify potential releases of radiation-containing materials in soil and fill material associated with slag deposits on-site, determine additional radiation source areas, and delineate the extent of radiological contamination at the Site. Analytical results indicated concentrations of radium-226 (Ra-226) above the EPA Site-Specific Action Level of 2.48 picocuries per gram (pCi/g) in the soil samples.

### **QAPP Worksheet #10: Conceptual Site Model (Concluded)**

In May 2017, RST 3 performed additional soil sampling at 20 test pit locations throughout the Site. A total of 88 soil samples were collected from all the test pits at 6-inch intervals below ground surface (bgs) up to a depth of 48 inches bgs, depending at what depth the native confining clay layer was encountered. The soil sampling event was conducted to further verify the vertical extent of potential releases of radiation-containing materials in soil and delineate the extent of the on-site radiological contamination. Analytical results indicated concentrations of Ra-226 above the EPA Site-Specific Action Level of 2.48 pCi/g in 32 of the soil samples.

In May 2018, RST 3 provided field sampling support to EPA's Emergency and Rapid Response Services (ERRS) contractor, Guardian Environmental Services (GES), with collecting 43 soil samples from 13 test pit locations throughout the Site for transportation and disposal cost purposes. Test pits were advanced to depths up to 48 inches bgs. ERRS restored all the test pit locations to their original condition and the samples were shipped to ERRS-procured laboratory for disposal analysis.

In September 2018, RST 3 provided site activity oversight, keeping daily records of site operations through photographic documentation and notations in the Site log book. Additionally, RST 3 conducted community air monitoring for particulates (dust) using DataRAM particulate air monitors, air sampling for radioactive particulates using RADēCO volumetric air samplers with filter media attachment, and post-excavation soil sampling.

## **QAPP Worksheet #11: Project/Data Quality Objectives**

### **1. State the Problem:**

Analytical results from a prior site investigation conducted by SAT and two Removal Assessment events conducted by RST 3 indicate the presence of contaminated soil associated with radioactive slag at the Site. Specifically, the concentrations radium-226 exceeded the EPA Site-Specific Action Level in soil samples collected during the site investigation and Removal Assessment events conducted at the Site. EPA is conducting a Removal Action to address the soil contamination at the Site. The selected remedy for the impacted AOCs is the excavation of contaminated soil, backfilling the excavated areas with clean, pre-analyzed soil, and restoring the AOCs as close as reasonably possible to their original state. Prior to backfilling the excavations, post-excavation soil sampling will be conducted by START V to verify that all the contaminated soils have been removed.

### **2. Identify the Goals of the Study:**

Up to 500 post-excavation soil samples and up to 100 concrete samples will be collected from the Site. Post-excavation soil samples will be collected from excavated AOCs to verify that the concentrations of target radionuclides are below the EPA Site-Specific Action Levels. Post-excavation soil samples will be collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 sq. ft.. Concrete samples will be collected to determine whether on-site concrete material can be repurposed for site restoration or if they need to be disposed of. Concrete samples will be collected from locations selected by the EPA OSC.

In order to prevent excavated AOCs from remaining open for extended period before backfilling, the soil samples collected from the various AOCs will be screened on-site using HPGe detector to perform quantitative gamma spectrometry analysis to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed to allow for the excavations to be backfilled with clean, pre-analyzed fill material. Following field screening, the samples will then be submitting for laboratory analysis.

If analytical results of post-excavation soil samples indicates concentrations of target radionuclides exceed the Site-Specific Action Level, then EPA will further excavate the location and area from where the post-excavation soil sample was collected and the location will be re-sampled for verification analysis.

If the analytical results of the concrete samples indicate concentrations of target radionuclides exceed the Site-Specific Action Level, then the concrete will be disposed of.

### **3. Identify Information Inputs:**

Up to 500 post-excavation soil samples and up to 100 concrete samples will be collected from the Site. Post-excavation soil samples will be collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 sq. ft.

## **QAPP Worksheet #11: Project/Data Quality Objectives (Continued)**

### **4. Define the Boundaries of the Study:**

**Overall project objectives include:** EPA is conducting a Removal Action to address the presence of radioactive slag in soil by excavating the AOCs and backfilling them with clean, pre-analyzed soils. Post-excavation soil sampling for field and laboratory analysis will be conducted at the various AOCs to verify that the concentrations of target radionuclides are below the EPA Site-Specific Action Levels. The post-excavation soil samples collected from the AOCs will be screened on-site using HPGe detector to perform quantitative gamma spectrometry analysis in order to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed and allow for expedited backfilling of the excavations for safety reason. Concrete sampling will be conducted to determine if on-site concrete material can be repurposed for site restoration or if they need to be disposed of.

**Who will use the data?** Data will be used by EPA, Region II OSC.

### **5. Develop the Analytic Approach:**

#### **Analytical Techniques:**

Isotopic Thorium by Alpha Spectroscopy via NAREL ACT-02FTH

Isotopic Uranium by Alpha Spectroscopy via NAREL ACT-02F-U

Other gamma emitting isotopes by Gamma Spectroscopy via NAREL GM-01-RA

Ra-226 and Ra-228 via 21-day ingrowth.

**Type of Data:** Definitive data for soil samples.

#### **Parameters:**

Soil: Isotopic thorium, isotopic uranium, radium-226 (in-growth), radium-228, and other gamma emitting radioisotopes.

**Field Screening Equipment:** HPGe (quantitative gamma spectrometry analysis)

#### **Sampling Equipment:**

Soil/concrete samples will be collected using dedicated plastic scoops, re-sealable plastic bags, and plastic sample jars.

**Access Agreement:** Obtained by EPA, Region II OSC.

**How much data are needed?** Up to 500 post-excavation soil samples and up to 100 concrete samples, including QA/QC samples.

### **6. Specify Performance or Acceptance Criteria:**

#### **How “good” does the data need to be in order to support the environmental decision?**

Sampling/analytical measurement performance criteria (MPC) for Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters will be established. Refer to Worksheet #12, criteria for performance measurement for definitive data.

## **QAPP Worksheet #11: Project/Data Quality Objectives (Concluded)**

### **Where, when, and how should the data be collected/generated?**

All samples will be collected on-site. Post excavation soil samples will be collected starting October 14, 2019. Concrete samples will be collected on a need basis as directed by the EPA OSC. Post-excavation soil samples will be collected from excavated AOCs at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 sq. ft. Post-excavation soil sampling for field and laboratory analysis will be conducted at the various AOCs to verify that the concentrations of target radionuclides are below the EPA Site-Specific Action Levels. The post-excavation soil samples collected from the AOCs will be screened on-site using HPGe detector to perform quantitative gamma spectrometry analysis in order to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed and allow for expedited backfilling of the excavations for safety reason. All sampling activities will be conducted in accordance with methods outlined in the Environmental Response Team (ERT)/Scientific Environmental Response and Analytical Services (SERAS) Standard Operating Procedures (SOPs). Soil/concrete samples will be collected for definitive data and QA/QC objectives.

### **7. Develop the Detailed Plan for Obtaining Data**

#### **Who will collect and generate the data?**

The soil samples will be collected by START V. Soil samples will be analyzed by NAREL. Soil analytical data will be validated by Weston CHP/data validation personnel.

**How will the data be reported?** All data will be reported by the assigned laboratory (Preliminary, Electronic, and Hard Copy format). The Site Project Manager will provide a Sampling Trip Report, Status Reports, Maps/Figures, Analytical Report, and Data Validation Report to the EPA OSC.

**How will the data be archived?** Electronic data deliverables will be archived in a Scribe database. Non-CLP data will be archived in EPA's document control room.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12A – Isotopic Thorium**

**Matrix:** Soil/Aqueous

**Analytical Group/Method:** Isotopic Thorium/Alpha Spectroscopy via NAREL ACT-02FTH

**Concentration Level:** Low/Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria <sup>1</sup>
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12B – Isotopic Uranium**

**Matrix:** Soil/Aqueous

**Analytical Group/Method:** Isotopic Uranium/Alpha Spectroscopy/NAREL ACT-02F-U

**Concentration Level:** Low/Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

**QAPP Worksheet #12: Measurement Performance Criteria**  
**QAPP Worksheet #12C – Gamma Spectroscopy**

**Matrix:** Soil/Aqueous

**Analytical Group/Method:** Gamma Spectroscopy/NAREL GM-01-RA

**Concentration Level:** Low/Medium

Data Quality Indicators (DQIs)	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Analytical Precision	Laboratory Sample Duplicates or Laboratory Control Sample Duplicates	$ z\text{-score}  < 3$
Analytical Accuracy/Bias	Laboratory Control Samples	$ z\text{-score}  < 3$
Contamination	Method blank	Refer to 13.1 of QA/QAM-1 on page 57

<sup>1</sup>NAREL Radiochemistry Quality Assurance Manual QA/QAM-1, Revision 11, January 31, 2019.

### QAPP Worksheet #13: Secondary Data Criteria and Limitations

Sources and types of secondary data include but are not limited to the following:

<b>Data Type</b>	<b>Data Source (originating organization, report title and date)</b>	<b>Data Uses Relative to Current Project</b>	<b>Factors Affecting the Reliability of Data and Limitations on Data Use</b>
EPA Investigation	Site Inspection Report. DCN#: 2223-2A-BKYP	Weston Solutions, Inc. (SAT Region 2)	To determine possible areas of observed contamination.
EPA Removal Assessments, July & August 2015	RST 3 Removal Assessment Trip Report, DCN#: RST3-02-D-0064	Weston Solutions, Inc. (RST 3 Region 2)	To verify the presence of residual contamination in on-site building, potential releases of radiation-containing materials in soil and fill material, determine radiation source areas, and delineate the extent of on-site radiological contamination
EPA Removal Assessments, March 2016	RST 3 Removal Assessment Trip Report	Weston Solutions, Inc. (RST 3 Region 2)	To identify additional source areas within a warehouse building located on one on-site property and to delineate the extent of on-site radiological contamination

### QAPP Worksheet #14 & 16: Project Tasks and Schedules

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Develop Project-Specific Health and Safety Plan (HASP)	WESTON	10/7/2019	10/10/2019	HASP	10/11/2019
Develop Project-Specific QAPP	WESTON	11/11/2019	12/4/2019	QAPP	12/5/2019
Coordination with EPA Region 2 RSCC for Regional or CLP analytical support or procure WESTON-subcontracted laboratory for analytical services	WESTON	NA	NA	Region II RSCC documentation (laboratory assignment) or WESTON Purchase Order for analytical services	NA
Scoping meeting Operations Manager, SPM, HSO, and sampling team to discuss data collection activities, objectives, and logistics	WESTON	10/7/2019	10/7/2019	Meeting Notes	NA
Mobilization/Demobilization	WESTON	10/13/2019	TBD	Field Notes	NA
Sample Collection Tasks	WESTON	10/14/2019	TBD	Field Notes	TBD
Analytical Tasks	WESTON	TBD	TBD	Field Notes/Laboratory Reports	TBD
Quality Control Tasks	WESTON	TBD	TBD	Report of Analyses/Data Package	TBD
Data Validation	WESTON	TBD	TBD	Validation Summary Report	TBD
Summarize Data	WESTON	TBD	TBD	Project-Specific Summary Report/Table	TBD
Develop Project-Specific Report	WESTON	TBD	TBD	Draft Project-Specific Report	TBD
Address EPA comments on Draft Project-Specific Report	WESTON	TBD	TBD	Project-Specific Report	TBD
Contract Closeout	WESTON	TBD	6/30/2020	Contract Closeout Report	6/30/2020

TBD – To be determined

NA – Not applicable

## **QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)**

### **Sampling Tasks:**

START V will collect up to 500 post-excavation soil samples and up to 100 concrete samples from locations to be determined on-site by the EPA OSC. Post-excavation soil samples will be collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 sq. ft. The post-excavation soil samples collected from the AOCs will be screened on-site using HPGe detector to perform quantitative gamma spectrometry analysis in order to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed and allow for expedited backfilling of the excavations for safety reason. Concrete samples will be collected from on-site locations selected by the EPA OSC.

### **Analysis Tasks:**

Soil/Concrete – Isotopic Thorium, Alpha Spectroscopy/NAREL ACT-02FTH  
Soil/Concrete – Isotopic Uranium, Alpha Spectroscopy/NAREL ACT-02F-U  
Soil/Concrete – Other gamma emitting isotopes, Gamma Spectroscopy/NAREL GM-01-RA  
Soil/Concrete – Ra-226 and Ra-228 via 21-day ingrowth

### **Decontamination:**

Soil and concrete samples will be collected using dedicated sampling equipment; therefore, rinsate blank will not be collected.

### **Quality Control Tasks:**

Field duplicates and additional sample volumes for MS/MSD analysis will be collected at a frequency of one per 20 field samples per matrix. All the samples will be collect for definitive data and QA/QC purposes.

### **Data Management Tasks:**

Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports. The following deliverables will be provided under this project:

Trip Report: A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within two weeks of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations).

Maps/Figures: Maps depicting site layout, contaminant source areas, and sample locations will be included in the trip report, as appropriate.

### **QAPP Worksheet #14 & 16: Project Tasks and Schedules (Continued)**

Analytical Report: An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review: A review of the data generated under this plan will be undertaken. The assessment of data acceptability or usability will be provided separately, or as part of the analytical report.

#### **Documentation and Records:**

All sample documents will be completed legibly, in ink. Any corrections or revisions will be made by lining through the incorrect entry and by initialing the error.

Field Logbook: The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. Field logbook will be bound and paginated. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following

1. Site name and project number
2. Name(s) of personnel on-site
3. Dates and times of all entries (military time preferred)
4. Descriptions of all site activities, site entry and exit times
5. Noteworthy events and discussions
6. Weather conditions
7. Site observations
8. Sample and sample location identification and description\*
9. Subcontractor information and names of on-site personnel
10. Date and time of sample collections, along with chain of custody information
11. Record of photographs
12. Site sketches
13. GPS Coordinates for each sample location

\* The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels: Sample labels will clearly identify the particular sample, and should include the following:

1. Site/Project number
2. START V Sample identification number.
3. Sample collection date and time
4. Analytical Parameters
5. Sample preservation

### **QAPP Worksheet #14 & 16: Project Tasks and Schedules (Concluded)**

Sample labels will be written in indelible ink and securely affixed to the sample container. Tie-on labels can be used if properly secured.

Custody Seals: Custody seals demonstrate that a sample container has not been tampered with or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

**Assessment/Audit Tasks**: No performance audit of field operations is anticipated at this time. If conducted, performance and system audit will be in accordance with the project plan.

**Data Review Tasks**: All soil and aqueous sample analytical data will be validated by Weston CHP/data validator.

The data generated under this QA/QC Sampling Plan will be evaluated according to guidance in the Uniform Federal Policy for Implementing Environmental Quality Systems: Evaluating, Assessing and Documenting Environmental Data Collection and Use Programs Part 1: UFP-QAPP (EPA-105-B-04-900A, March 2005); Part 2B: Quality Assurance/Quality Control Compendium: Minimum QA/QC Activities (EPA-105-B-04-900B, March 2005). Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity.

**QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits**  
**QAPP Worksheet #15A – Isotopic Thorium**

**Matrix:** Soil/Aqueous

**Analytical Group/Method:** Isotopic Thorium/Alpha Spectroscopy via NAREL ACT-02FTH

**Concentration Level:** Low/Medium

Analyte	CAS Number	Project Quantitation Limit	Method CRQLs (Units)	NAREL Method Detection Limit (Units)
Thorium-227 (Th-227)	15623-47-9	NA	NA	*
Thorium-228 (Th-228)	14274-82-9	NA	NA	*
Thorium-230 (Th-230)	14269-63-7	NA	NA	0.14 pCi/g
Thorium-232 (Th-232)	7440-29-1	NA	NA	0.10 pCi/g

\*NAREL does not provide MDC for Th-227 and Th-228

pCi/g – Picocuries per gram

NA – Not Applicable

**QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits**  
**QAPP Worksheet #15B – Isotopic Uranium**

**Matrix:** Soil/Aqueous

**Analytical Group/Method:** Isotopic Uranium/Alpha Spectroscopy via NAREL ACT-02-U

**Concentration Level:** Low/Medium

Analyte	CAS Number	Project Quantitation Limit	Method CRQLs (Units)	NAREL Method Detection Limit (Units)
Uranium-234 (U-234)	13966-29-5	NA	NA	0.10 pCi/g
Uranium-235 (U-235)	15117-96-1	NA	NA	0.12 pCi/g
Uranium-238 (U-238)	7440-61-1	NA	NA	0.10 pCi/g

NA – Not Applicable

pCi/g – Picocuries per gram

**QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits**  
**QAPP Worksheet #15C – Gamma Spectroscopy**

**Matrix:** Soil/Aqueous

**Analytical Group/Method:** Gamma Spectroscopy/NAREL GM-01-RA

**Concentration Level:** Low/Medium

Analyte	CAS Number	Project Quantitation Limit	Method CRQLs (Units)	NAREL Method Detection Limit (Units)
Bismuth-207 (Bi-207)	13982-38-2	NA	NA	1.0 pCi/g
Bismuth-212 (Bi-212)	14913-49-6	NA	NA	0.1 pCi/g
Bismuth-214 (Bi-214)	14733-03-0	NA	NA	0.1 pCi/g
Cesium-137 (Cs-137)	10045-97-3	NA	NA	0.1 pCi/g
Europium-155 (Eu-155)	14391-16-3	NA	NA	1.0 pCi/g
Potassium-40 (K-40)	13966-00-2	NA	NA	0.2 pCi/g
Lead-210 (Pb-210)	14255-04-0	NA	NA	1.0 pCi/g
Lead-212 (Pb-212)	7439-92-1	NA	NA	0.1 pCi/g
Lead-214 (Pb-214)	15067-28-4	NA	NA	0.1 pCi/g
Radium-226 (Ra-226)*	13982-63-3	NA	NA	0.1 (Bi/Pb-214) pCi/g
Radium-228 (Ra-228)	15262-20-1	NA	NA	0.1 (Ac-228) pCi/g
Thorium-234 (Th-234)	15065-10-8	NA	NA	1.0 pCi/g
Thallium-208 (Tl-208)	14913-50-9	NA	NA	0.1 pCi/g
Uranium-235 (U-235)	15117-96-1	NA	NA	0.2 pCi/g
Uranium-238 (U-238)	7440-61-1	NA	NA	Use Pb/Bi-214

\*Ra-226 via 21 day ingrowth

pCi/g – Picocuries per gram

NA – Not Applicable

### QAPP Worksheet #17: Sampling Design and Rationale

As part of Removal Action activities at the Site, START V has been tasked by EPA with the collection of up to 500 post-excavation soil samples and up to 100 concrete samples. All field sampling activities will be conducted in accordance with EPA ERT/SERAS SOP No. 2001: *General Field Sampling Guidelines* and SOP No. 2012: *Soil Sampling*. Post-excavation soil sampling for field and laboratory analysis will be conducted at the various AOCs to verify that the concentrations of target radionuclides are below the EPA Site-Specific Action Levels. The post-excavation soil samples collected from the AOCs will be screened on-site using HPGe detector to perform quantitative gamma spectrometry analysis in order to verify that the vertical and horizontal extents of the contamination in the AOCs have been removed and allow for expedited backfilling of the excavations for safety reason. Post-excavation soil samples will be collected at a frequency of one sidewall soil sample per 30 linear feet of the excavation perimeter and one bottom soil sample at a frequency of one per 900 sq. ft. Concrete samples will be collected to determine if on-site concrete material can be repurposed for site restoration or if they need to be disposed of. Concrete samples will be collected from locations selected by the EPA OSC using dedicated plastic scoops and placed directly into 32 ounce (oz) plastic jars. The soil samples will be collected in re-sealable plastic bags using dedicated, disposable plastic scoops. The samples will be homogenized in the plastic bags prior to being transferred into 32 oz. plastic jars. Field duplicates and additional sample volumes for MS/MSD analysis will be collected at a frequency of one per 20 field samples per matrix. All the samples will be collect for definitive data and QA/QC purposes and will be analyzed by EPA NAREL for Isotopic thorium, isotopic uranium, radium-226 (in-growth), radium-228, and other gamma emitting radioisotopes.

This sampling design is based on information currently available and may be modified on-site in light of field screening results and other acquired information.

The following laboratories will provide the analyses indicated:

Lab Name/Location/Contact	Matrix	Parameters
National Analytical Radiation Environmental Laboratory (NAREL) 540 South Morris Avenue, Montgomery, AL 36115 Attn: Tonya Hudson Phone: 334-270-3433	Soil	Alpha Spectroscopy/Isotopic thorium Alpha Spectroscopy/Isotopic uranium Gamma Spectroscopy Ra-226 and Ra-228 via 21-day ingrowth

Refer to Worksheet #20 for QA/QC samples, sampling methods, and SOPs.

### QAPP Worksheet #18: Sampling Locations and Methods/SOP Requirements Table

The following information is project-specific and will be included in the site-specific QAPP.

Sampling Location	Matrix	(Units)	Sample Type No. of Samples (identify field duplicates)	Analyte/Analytical Group(s)	Sampling SOP Reference <sup>1</sup>	Comments
Up to 475	Soil	pCi/g	475 (25)	Isotopic thorium, isotopic uranium, and other gamma emitting isotopes	SOP# 2001, 2012	Verify that excavated AOCs do not contain radiation sources
Up to 100	Concrete	pCi/g	95 (5)	Isotopic thorium, isotopic uranium, and other gamma emitting isotopes	SOP# 2001, 2012	Verify if concrete can be repurposed or disposed of

pCi/g – Picocuries per gram

The website for EPA-ERT SOPs is: [https://response.epa.gov/site/site\\_profile.aspx?site\\_id=2107](https://response.epa.gov/site/site_profile.aspx?site_id=2107)

### QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

**Laboratory:** NAREL, 540 South Morris Avenue, Montgomery, AL 36115

**POC:** Tonya Hudson, Phone: 334-270-3433, Email: [HUDSON.TONYA@EPA.GOV](mailto:HUDSON.TONYA@EPA.GOV)

**List Any Required Accreditations/Certifications:** Not applicable.

**Back-up Laboratory:** Not Applicable

**Sample Delivery Method:** Fed Ex

Matrix	Analytical Group	Analytical and Preparation Method/SOP Reference <sup>1</sup>	Accreditation Expiration Date	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/analysis)	Data Package Turnaround Time
Soil/Concrete	Isotopic Thorium	NAREL ACT-02FTH	NA	1,000g 32oz Plastic Jar (wide mouth)	None	None	60 days
Soil/Concrete	Isotopic Uranium	NAREL ACT-02F-U					
Soil/Concrete	Other Gamma Isotopes	NAREL GM-01-RA					

\*1,000 grams total soil for gamma, U, & TH will be enough. Plastic jars or doubled Ziplock bags are preferred to glass.

**QAPP Worksheet #20: Field Quality Control Sample Summary**

<b>Matrix</b>	<b>Analytical Group</b>	<b>No. of Field Samples<sup>1</sup></b>	<b>No. of Field Duplicates</b>	<b>No. of Extra Volume Laboratory QC (e.g., MS/MSD) Samples</b>	<b>No. of Field Blanks</b>	<b>No. of Equip. Blanks</b>	<b>No. of Trip. Blanks</b>	<b>No of others</b>	<b>Total No. of Samples to Lab</b>
Soil	Isotopic Thorium	Up to 475	25	25	NR	NR	NR	NR	500
Soil	Isotopic Uranium	Up to 475	25	25	NR	NR	NR	NR	500
Soil	Other Gamma Isotopes	Up to 475	25	25	NR	NR	NR	NR	500
Concrete	Isotopic Thorium	Up to 95	5	5	NR	NR	NR	NR	100
Concrete	Isotopic Uranium	Up to 95	5	5	NR	NR	NR	NR	100
Concrete	Other Gamma Isotopes	Up to 95	5	5	NR	NR	NR	NR	100

NR – Not Required

**QAPP Worksheet #21: Project Sampling SOP References Table**

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comment
<u>SOP#: 2001</u>	General Field Sampling Guidelines (all media); Rev. 0.1, June 7, 2013	ERT/SERAS	Site-Specific	N	NA
<u>SOP#: 2012</u>	Soil Sampling; Rev. 0.1, July 11, 2001	ERT/SERAS	plastic scoops, re-sealable plastic bags, and appropriate sample jars	N	NA

See Attachment B for SOP # 2001, 2012

[https://response.epa.gov/site/site\\_profile.aspx?site\\_id=2107](https://response.epa.gov/site/site_profile.aspx?site_id=2107)

**QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table**

Field Equipment	Calibration Activity	Maintenance Activity	Testing/ Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
HPGE	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	Performed by EPA	NA
HPGe will be provided and maintained by EPA								

NA – Not applicable

### QAPP Worksheet #23: Analytical SOPs

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
NC/SOP-8	NAREL ACT-02F-TH	Definitive Data	Soil/Aqueous	Alpha Spectroscopy	NAREL	N
NC/SOP-8	NAREL ACT-02F-U	Definitive Data	Soil/Aqueous	Alpha Spectroscopy	NAREL	N
AM/SOP-3	NAREL GAM-01-RA	Definitive Data	Soil/Aqueous	Gamma Spectroscopy	NAREL	N

### QAPP Worksheet #24: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
HPGe	See Section 10.0 of SOP 9 (NC/SOP-10)	5 years	Delta values of $\pm 5\%$ for FWHM & Efficiency	Root Cause Analysis	Instrument Administrator	NC/SOP-10
Alpha Spectrometers	Refer to NC/SOP-8 Section 10	5 years	Refer to NC/SOP-8 Section 10.5	Root Cause Analysis	Instrument Administrator	NC/SOP-8

### QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action (CA)	Responsible Person for CA	SOP Reference <sup>1</sup>
HPGe		Contamination Check	Weekly + each day before & after detector is used	Control Chart Limits	Root Cause Analysis	Instrument Administrator	AM/SOP-3
HPGe		QC Check	Weekly + each day before & after detector is used	Energy - $\pm 1$ keV FWHM – 30% above & below the mean Efficiency – control chart limits	Root Cause Analysis	Instrument Administrator	AM/SOP-3
Alpha Spectrometers		Background	Biweekly	Control Charted	Root Cause Analysis	Instrument Administrator	NC/SOP-8
Alpha Spectrometers		Eff. Check	Weekly	Control Charted FWHM – 30% above & below the mean Efficiency – control chart limits	Root Cause Analysis	Instrument Administrator	NC/SOP-8

### QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal

**Sampling Organization:** Weston Solutions, Inc., START V

**Laboratory:** Soil and Aqueous/NAREL

**Method of sample delivery (shipper/carrier):** Hand Delivered or FedEx

**Number of days from reporting until sample disposal:** 60 days

Activity	Organization and Title or Position of Person Responsible for the Activity	SOP Reference <sup>1</sup>
Sample Labeling	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Chain-of-Custody Form Completion	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Packaging	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Shipping Coordination	START V Site Project Manager, START V Sampling Team	EPA-540-R-014-013, October 2014
Sample Receipt, Inspection, & Log-in	Laboratory Sample Custodian	EPA-540-R-014-013, October 2014, NAREL
Sample Custody and Storage	Laboratory Sample Custodian /Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014, NAREL
Sample Disposal	Field Personnel/Laboratory Sample Custodian /Laboratory Analytical Personnel	EPA-540-R-014-013, October 2014, NAREL

**Sample Identification Procedures:** Each sample collected by START V will be designated by a code that will identify the sample in accordance with previous sampling (if applicable). For radon and soil samples, an alpha-numeric code that identifies the site-specific property number will begin the sample nomenclature, followed by combined media type and location, followed by sample date for radon sample and sample depth for soil sample. After the date/depth, the sequential sample numbers will be listed. Duplicate samples will be identified in the same manner as other samples and will be distinguished and documented in the field logbook.

Example Soil Sample: A06-PE001-0612-01 = Area 6 (A06), Post-Excavation sample location 001 (PE001), Soil sample collected from depths 6 inches to 12 inches bgs (0612), Sample number 01, Field Duplicate will be 02.

Example Concrete Sample: N002-CC001-01 = Property (N002), Concrete sample location 001 (CC001), Sample number 1 (01), Field Duplicate will be 02

NOTE: This nomenclature is subject to change at the discretion of the OSC.

### **QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal (Concluded)**

**Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):** Each sample will be individually identified and labeled after collection, then sealed with custody seals and enclosed in a plastic cooler. The sample information will be COC forms, and the samples shipped to the appropriate laboratory via overnight delivery service or courier. Chain-of-custody records must be prepared in Scribe to accompany samples from the time of collection and throughout the shipping process. Each individual in possession of the samples must sign and date the sample COC Record. The chain-of-custody record will be considered completed upon receipt at the laboratory. A traffic report and chain-of-custody record will be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook. The chain-of-custody record should include (at minimum) the following: 1) Sample identification number; 2) Sample information; 3) Sample location; 4) Sample date; 5) Sample Time; 6) Sample Type Matrix; 7) Sample Container Type; 8) Sample Analysis Requested; 9) Name(s) and signature(s) of sampler(s); and 10) Signature(s) of any individual(s) with custody of samples.

A separate chain-of-custody form must accompany each cooler for each daily shipment. The chain-of-custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain-of-custody for all samples in case of mis-shipment.

**Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal)** Within the laboratory, the person responsible for sample receipt must sign and date the chain-of-custody form; verify that custody seals are intact on shipping containers; compare samples received against those listed on the chain-of-custody form; examine all samples for possible shipping damage and improper sample preservation; note on the chain-of-custody record that specific samples were damaged; notify sampling personnel as soon as possible so that appropriate samples may be regenerated; verify that sample holding times have not been exceeded; maintain laboratory chain-of-custody documentation; and place the samples in the appropriate laboratory storage. At this time, no samples will be archived at the laboratory. Disposal of the samples will occur only after analyses and QA/QC checks are completed.

<sup>1</sup>Note: Refer to Contract Laboratory Program Guidance for Field Samplers, EPA-540-R-014-013, October 2014 at:  
[https://www.epa.gov/sites/production/files/2015-03/documents/samplers\\_guide.pdf](https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf)

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28A – Isotopic Thorium**

<b>Matrix</b>	Soil/Concrete					
<b>Analytical Group</b>	Isotopic Thorium					
<b>Concentration Level</b>	Low/Medium					
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012					
<b>Analytical Method/SOP Reference</b>	Alpha Spectroscopy/NAREL ACT-02FTH					
<b>Sampler's Name</b>	Bernard Nwosu					
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V					
<b>Analytical Organization</b>	NAREL					
<b>No. of Sample Locations</b>	475/95					
<b>Lab QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Duplicate	1 per 20	z-score   < 3	Reanalysis	Analyst	Precision	z-score   < 3
Laboratory Control	1 per 20	z-score   < 3	Reanalysis	Analyst	Accuracy	z-score   < 3
Reagent Blank	1 per 20	0 ± 3 sigma	Reanalysis	Analyst	Precision	0 ± 3 sigma

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28B – Isotopic Uranium**

<b>Matrix</b>	Soil/Concrete					
<b>Analytical Group</b>	Isotopic Uranium					
<b>Concentration Level</b>	Low/Medium					
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012					
<b>Analytical Method/SOP Reference</b>	Alpha Spectroscopy/NAREL ACT-02F-U					
<b>Sampler's Name</b>	Bernard Nwosu					
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V					
<b>Analytical Organization</b>	NAREL					
<b>No. of Sample Locations</b>	475/95					
<b>Lab QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Duplicate	1 per 20	z-score   < 3	Reanalysis	Analyst	Precision	z-score   < 3
Reagent Blank	1 per 20	0 ± 3 sigma	Reanalysis	Analyst	Accuracy	0 ± 3 sigma
Duplicate	1 per 20	z-score   < 3	Reanalysis	Analyst	Precision	z-score   < 3

**QAPP Worksheet #28: QC Samples Table**  
**QAPP Worksheet #28C – Gamma Spectroscopy**

<b>Matrix</b>	Soil/Concrete					
<b>Analytical Group</b>	Gamma Spectroscopy					
<b>Concentration Level</b>	Low/Medium					
<b>Sampling SOP(s)</b>	ERT/SERAS SOP# 2001, 2012					
<b>Analytical Method/SOP Reference</b>	Gamma Spectroscopy/NAREL GM-01-RA					
<b>Sampler's Name</b>	Bernard Nwosu					
<b>Field Sampling Organization</b>	Weston Solutions, Inc., START V					
<b>Analytical Organization</b>	NAREL					
<b>No. of Sample Locations</b>	475/95					
<b>Lab QC Sample:</b>	<b>Frequency/ Number</b>	<b>Method/SOP QC Acceptance Limits</b>	<b>Corrective Action</b>	<b>Person(s) Responsible for Corrective Action</b>	<b>Data Quality Indicator (DQI)</b>	<b>Measurement Performance Criteria</b>
Duplicate	1 per 20	z-score   < 3	Reanalysis	Analyst	Precision	z-score   < 3
Laboratory Control	1 per 20	z-score   < 3	Reanalysis	Analyst	Accuracy	z-score   < 3
Reagent Blank	1 per 20	0 ± 3 sigma	Reanalysis	Analyst	Precision	0 ± 3 sigma

### QAPP Worksheet #29: Project Documents and Records

Sample Collection and Field Records			
Record	Generation	Verification	Storage Location/Archival
Field Logbook or Data Collection Sheets	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Chain-of-Custody Forms	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Custody Seals	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Air Bills	SPM/Field Personnel	Group Leader or Operations Manager	Project File
Daily QC Reports	SPM	Group Leader or Operations Manager	Project File
Deviations	SPM/Field Scientist	Group Leader or Operations Manager	Project File
Corrective Action Reports	Delegated QA Manager	Operations Manager or Program Manager or designee	Project File
Correspondence	SPM	Delegated QA Manager	Project File
Field Sample Results/Measurements	SPM/Field Scientist	Delegated QA Manager	Project File
Tailgate Safety Meeting Items	SPM/Field Safety Officer	Delegated QA Manager	Project File

Project Assessments			
Record	Generation	Verification	Storage Location/Archival
Data Verification Checklists	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Validation Report	Data validator/Chemist QA/QC Specialist	Group Leader or Operations Manager	Project File
Data Usability Assessment Report	Site Project Manager	Group Leader or Operations Manager	Project File
Corrective Action Reports	Group Leader/HSO/Chemist QA/QC Specialist	Group Leader	Project File
Correspondence	Group Leader/HSO/Chemist QA/QC Specialist	Program Manager or designee	Project File

## QAPP Worksheet #29: Project Documents and Records (Concluded)

Laboratory Records			
Record	Generation	Verification	Storage Location/Archival
Sample Receipt, Custody, and Checklist	Laboratory Sample Receiving	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Calibration Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Standard Traceability Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Prep Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Run Logs	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Equipment Maintenance, Testing, and Inspection Logs	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File
Corrective Action Reports	Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory File and Project File
Laboratory Analytical Results	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Laboratory QC Samples, Standards, and Checks	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Instrument Results (raw data) for Primary Samples, Standards, QC Checks, and QC Samples	Laboratory Technician/ Laboratory QA Manager	Laboratory PM/Delegated QA Manager	Laboratory Data Package and Project File
Sample Disposal Records	Laboratory Technician	Laboratory PM/Delegated QA Manager	Laboratory File

Laboratory Data Deliverables <sup>1</sup>						
Record	VOCs	SVOCs	PCBs	Pesticides	Metals	Other <sup>2</sup>
Narrative	NA	NA	NA	NA	NA	Y
Chain of Custody	NA	NA	NA	NA	NA	Y
Summary Results	NA	NA	NA	NA	NA	Y
QC Results	NA	NA	NA	NA	NA	Y
Chromatograms or raw data	NA	NA	NA	NA	NA	Y
Tentatively Identified Compounds	NA	NA	NA	NA	NA	Y

<sup>1</sup> The blank Laboratory Data Deliverables table is designed to be a checklist for use in supporting data completeness. The records and analytical groups in this table are not all inclusive of those that may be used on a specific project and should be modified and utilized by the Delegated SPM as applicable

<sup>2</sup> Isotopic Thorium/Alpha Spectroscopy, Isotopic Uranium/Alpha Spectroscopy, and Gamma Spectroscopy.

### QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action

Assessment Type	Responsible Party & Organization	Number/Frequency	Estimated Dates	Assessment Deliverable	Deliverable Due Date
Field Sampling Technical Systems Audit (TSA) <sup>1</sup>	Chemist QA/QC Specialist (or designee) and Group Leader or Operations Manager WESTON	As needed, as determined by WESTON Chemist QA/QC Specialist (or designee) and Group Leader or Program Manager WESTON	To be completed near the beginning of field sample collection activities/9/8/2019	TSA Memorandum and Checklist	48 to 72 hours following assessment
Laboratory TSA <sup>2</sup>	Laboratory QA Manager Regulatory Agency	CLP, NAREL, and certified subcontract laboratories are routinely audited by accrediting authorities.	Every Year	Written Report	14 Days
Data Validation	Chemist QA/QC Specialist or CHP/Data Validator WESTON	Each data package for which data validation was requested; varies by site	Within 42 days from the sampling date	Data Validation Report	Varies by site
Management Review	Group Leader and/or Operations Manager WESTON	Varies; as determined by WESTON Program Manager	Varies; as determined by WESTON Program Manager	Quality Management Report (memo/e-mail to file)	1-2 weeks following assessment

<sup>1</sup> Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

<sup>2</sup> Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

**Worksheet 31, 32 & 33 — Assessments and Corrective Action (Concluded)**

<b>Assessment Type</b>	<b>Responsibility for Responding to Assessment Findings</b>	<b>Assessment Response Documentation</b>	<b>Timeframe for Response</b>	<b>Responsibility for Implementing Corrective Action</b>	<b>Responsible for Monitoring Corrective Action Implementation</b>
Field Sampling Technical Systems Audit (TSA) <sup>1</sup>	SPM, WESTON	Findings of field audit.	24 hours of receipt of audit report	Operations Manager, WESTON	SPM or Operations Manager, WESTON
Laboratory TSA <sup>2</sup>	NAREL QA Manager, Tonya Hudson Chemist QA/QC Specialist (or designee), WESTON	Written response to Weston Chemist QA/QC Specialist  EPA Region 2 to address deficiencies	1 week of receipt of request from EPA Region 2 (or START V on behalf of EPA)	Laboratory Manager, NAREL	Quality Manager (or designee) and/or Chemist, WESTON
Data Validation	Non-CLP data: Chemist QA/QC Specialist (or designee), WESTON	Validation Report	Within 48 hours of receipt of validation inquiry	Laboratory QA Manager and/or Chemist	Chemist, WESTON
Management Review	Program Manager, WESTON	Quality Management Response	48 hours of receipt of Quality Management report	Program Manager, WESTON	Chemist QA/QC Specialist (or designee) and Program Manager, WESTON

<sup>1</sup> Field sampling TSAs may include, but are not limited to the following: sample collection records; sample handling, preservation, packaging, shipping, and custody records; equipment operation, maintenance, and calibration records.

<sup>2</sup> Laboratory TSAs may include, but are not limited to the following: sample log-in, identification, storage, tracking, and custody procedures; sample and standards preparation procedures; availability of analytical instruments; analytical instrument operation, maintenance, and calibration records; laboratory security procedures; qualifications of analysts; case file organization and data handling procedures.

### QAPP Worksheet #34: Data Verification and Validation Inputs

Item	Description	Verification (completeness)	Validation (conformance to specifications)
<b>Planning Documents/Records</b>			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
5	Laboratory QA Manual	X	
6	Laboratory Certifications	X	
<b>Field Records</b>			
7	Field Logbooks	X	X
8	Equipment Calibration Records	X	X
9	Chain of Custody Forms	X	X
10	Sampling Diagrams/Surveys	X	X
11	Drilling Logs	X	X
12	Geophysics Reports	X	X
13	Relevant Correspondence	X	X
14	Change Orders/Deviations	X	X
15	Field Audit Reports	X	X
16	Field Corrective Action Reports	X	X
17	Sample Location Verification (Worksheet 18)	X	X
<b>Analytical Data Package and Other Laboratory Deliverables</b>			
18	Cover Sheet (laboratory identifying information)	X	X
19	Case Narrative	X	X
20	Internal Laboratory Chain of Custody	X	X
21	Sample Receipt Records	X	X
22	Sample Chronology (i.e. dates and times of receipt, preparation, & analysis)	X	X
23	Communication Records	X	X
24	Project-specific PT Sample Results	NA	NA
25	RL/MDL Establishment and Verification	X	X
26	Standards Traceability	NA	NA
27	Instrument Calibration Records	X	X
28	Definition of Laboratory Qualifiers	X	X
29	Results Reporting Forms	X	X
30	QC Sample Results	X	X
31	Corrective Action Reports	X	X
32	Raw Data	X	X
33	Electronic Data Deliverable	X	X

### QAPP Worksheet #35: Data Verification Procedures

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Site-specific QAPP	Contract QAPP, Work Scope in TD	Verify sampling and analytical methods specified in site-specific QAPP are correct and all contract QAPP protocols are followed and required QC samples will be collected in the correct bottles and properly preserved.	Bernard Nwosu WESTON Operations Manager Smita Sumbaly, WESTON Chemist QA/QC Specialist
Field Logs and SOPs	Contract and site-specific QAPP, SOPs	Ensure that all field sampling SOPs specified in site-specific QAPP were followed.	WESTON SPM and Data Validation Personnel
Analytical SOPs	Analytical Method and Contract QAPP	Ensure that laboratory analytical SOPs comply with the published method.	Laboratory QA Manager: Tonya Hudson WESTON Chemist QA/QC Specialist /Smita Sumbaly
Laboratory QA Manual	EPA Guidance Documents	Verify that best practices specified in EPA Guidance Documents are incorporated into the Laboratory QA Manual.	Laboratory QA Manager: Tonya Hudson
Laboratory Certifications	Generic and site-specific QAPP	Ensure that laboratory performing analytical sample analyses has current State, National Environmental Laboratory Accreditation Program, National Voluntary Laboratory Accreditation Program, or American Industrial Hygiene Association certifications as required by the project.	Laboratory QA Manager: Tonya Hudson
Laboratory Deliverables	Chain of Custody	Chain-of-custody forms will be verified against the sample cooler they represent. Sample Acceptance Checklist is completed. The Precision Environmental, Inc. and Radon Testing Corporation of America staff supervisor utilizes the analyses request information and the external COC to review the accuracy and completeness of LIMS log-in entries, as reflected on the LIMS Sample Receipt Form Details can be found in Laboratory Quality Management Plan, SOP G-25	Laboratory QA Manager: Tonya Hudson EPA RSCC/SMO coordinator

### QAPP Worksheet #35: Data Verification Procedures (Concluded)

Records Reviewed	Required Documents	Process Description	Responsible Person, Organization
Laboratory Deliverables	Chain of Custody	Chain-of-custody forms will be verified against the sample cooler they represent. Sample Acceptance Checklist is completed. The non-CLP labs, sample custodian utilizes the analyses request information and the external COC to review the accuracy and completeness of LIMS log-in entries, as reflected on the LIMS Sample Receipt Form Details can be found in Laboratory Quality Management Plan.	Laboratory sample custodian , Laboratory QA Manager: Tonya Hudson
Laboratory QA Manual	Analytical data package/ Final Report	The procedures for data review : 1- Data reduction/review by Primary Analyst. 2- Review complete data package (raw data) by independent Peer Reviewer 3- The Branch Chief/Section Chief reviews the project documentation for completeness followed by a QA review by the QAO 4- Final review by Branch Chief/Section Chief prior to release, this review is to ensure completeness and general compliance with the objectives of the project. This final review typically does not include a review of raw data. Details can be found in Laboratory Quality Management Plan and SOP G-26.	Primary Analyst, Peer Reviewer, Sample Project Coordinator, Quality Assurance Officer, Section Chief/ Branch Chief. NAREL – EPA laboratory
Field Logbook, Field Sheets, Sample Diagrams/ Surveys	site-specific QAPP	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	WESTON SPM and Operations Manager
Field Equipment Calibration Records	site-specific QAPP, SOPs, field logbook	Ensure that all field analytical instrumentation SOPs for equipment calibration were followed.	WESTON SPM and Operations Manager
Relevant reports and correspondence	site-specific QAPP	Verify that reports are present and complete for each day of field activities. Verify that correspondence is documented and was reported in accordance with requirements.	WESTON SPM and Operations Manager
Audit Reports, Corrective Action Reports	site-specific QAPP	Verify that all planned audits were conducted. Examine audit reports. For any deficiencies noted, verify that corrective action was implemented according to plan.	Smita Sumbaly, WESTON Chemist QA/QC Specialist Laboratory PM, NAREL

### QAPP Worksheet #36: Data Validation Procedures

The following information is project-specific and will be identified in the site-specific or QAPP.

**Data Validator:** Weston, START V Data validator

Analytical Group/Method	Data Deliverable Requirements	Analytical Specifications	MPC	Percent of Data Packages to be Validated	Percent of Raw Data Reviewed	Percent of Results to be Recalculated	Validation Procedure	Validation Code	Electronic Validation Program/Version
NAREL									
Soil/Concrete	SEDD Stage IIa/IIb	NAREL ACT-02F-TH	Worksheets 12, 24, 28	100%	100%	100%	Sampling Method, Lab SOP, Calculations, QC Criteria	Validated Manually (VM)	Excel spreadsheet
Soil/Concrete	SEDD Stage IIa/IIb	NAREL ACT-02F-U	Worksheets 12, 24, 28	100%	100%	100%	Sampling Method, Lab SOP, Calculations, QC Criteria	Validated Manually (VM)	Excel spreadsheet
Soil/Concrete	SEDD Stage IIa/IIb	NAREL GAM-01-RA	Worksheets 12, 24, 28	100%	100%	100%	Sampling Method, Lab SOP, Calculations, QC Criteria	Validated Manually (VM)	Excel spreadsheet

### **QAPP Worksheet #37: Usability Assessment**

Data usability assessments (DUA) will be performed as directed by EPA. This worksheet documents procedures that will be used to perform the DUA. The DUA is performed at the conclusion of data collection activities using the outputs from data verification and data validation (i.e., data of known and documented quality). It is the data interpretation phase, which involves a qualitative and quantitative evaluation of environmental data to determine whether the Site data are of the right type, quality, and quantity to support the decisions that need to be made. It involves a retrospective evaluation of the systematic planning process, and involves participation by key members of the project team. The DUA evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence.

Data, whether generated in the field or by the laboratory, are tabulated and reviewed for PARCCS by the SPM for field data or the data validator for laboratory data. The review of the PARCC Data Quality Indicators (DQI) will compare with the Data Quality Objectives (DQO) detailed in the site-specific QAPP, the analytical methods used and impact of any qualitative and quantitative trends will be examined to determine if bias exists. A hard copy of field data is maintained in a designated field or site logbook. Laboratory data packages are validated, and final data reports are generated. All documents and logbooks are assigned unique and specific control numbers to allow tracking and management.

Where applicable, the following documents will be followed to evaluate data for fitness in decision making: EPA QA/G-4, Guidance on Systematic Planning using the Data Quality Objectives Process, EPA/240/B-06/001, February 2006, and EPA QA/G-9R, Guidance for Data Quality Assessment, A reviewer's Guide EPA/240/B-06/002, February 2006.

Personnel (organization and position/title) responsible for participating in the data usability assessment may include, but not be limited to:

- START V Operations Manager;
- START V Quality Manager (or designee);
- START V Risk Assessor;
- START V SPM;
- START V Chemist QA/QC Specialist;
- START V Statistician.

Based on project-specific oversight responsibilities and analytical scopes, this DUA worksheet outlines the approach that will be taken as the analytical scope expands on a project-specific basis.

The following general steps will be followed to assure that the data usability assessment evaluates whether underlying assumptions used during systematic planning are supported, sources of uncertainty have been accounted for and are acceptable, data are representative of the population of interest, and the results can be used as intended, with the acceptable level of confidence:

### **QAPP Worksheet #37: Usability Assessment (Concluded)**

**Step 1 – Review the project’s objectives and sampling design:** This includes reviewing the DQOs and MPC to make sure they are still applicable. The sampling design will be consistent with stated DQOs.

**Step 2 – Review the data verification and data validation outputs:** Graphs, maps, and tables can be prepared to summarize the data. Deviations from activities planned in the Project QAPP should be considered, including samples not collected (potential data gaps), holding time exceedances, damaged samples, impact of non-compliant PE sample results, and SOP deviations. The implications of unacceptable QC sample results will be assessed.

**Step 3 – Verify the assumptions of the selected statistical method:** The underlying assumptions for the selected statistical methods (if specified in the QAPP) will be verified for validity. Common assumptions include the distributional form of the data, independence of the data, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions usually are not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may be selected.

**Step 4 - Implement the statistical method:** If specified in the site-specific QAPP, statistical procedures will be implemented for analyzing the data and reviewing underlying assumptions. For a decision project that involves hypothesis testing (e.g., “concentrations of lead in groundwater are below the action level”) the consequences of selecting the incorrect alternative will be considered; for estimation projects (e.g., establishing a boundary for surface soil contamination), the tolerance for uncertainty in measurements will be considered.

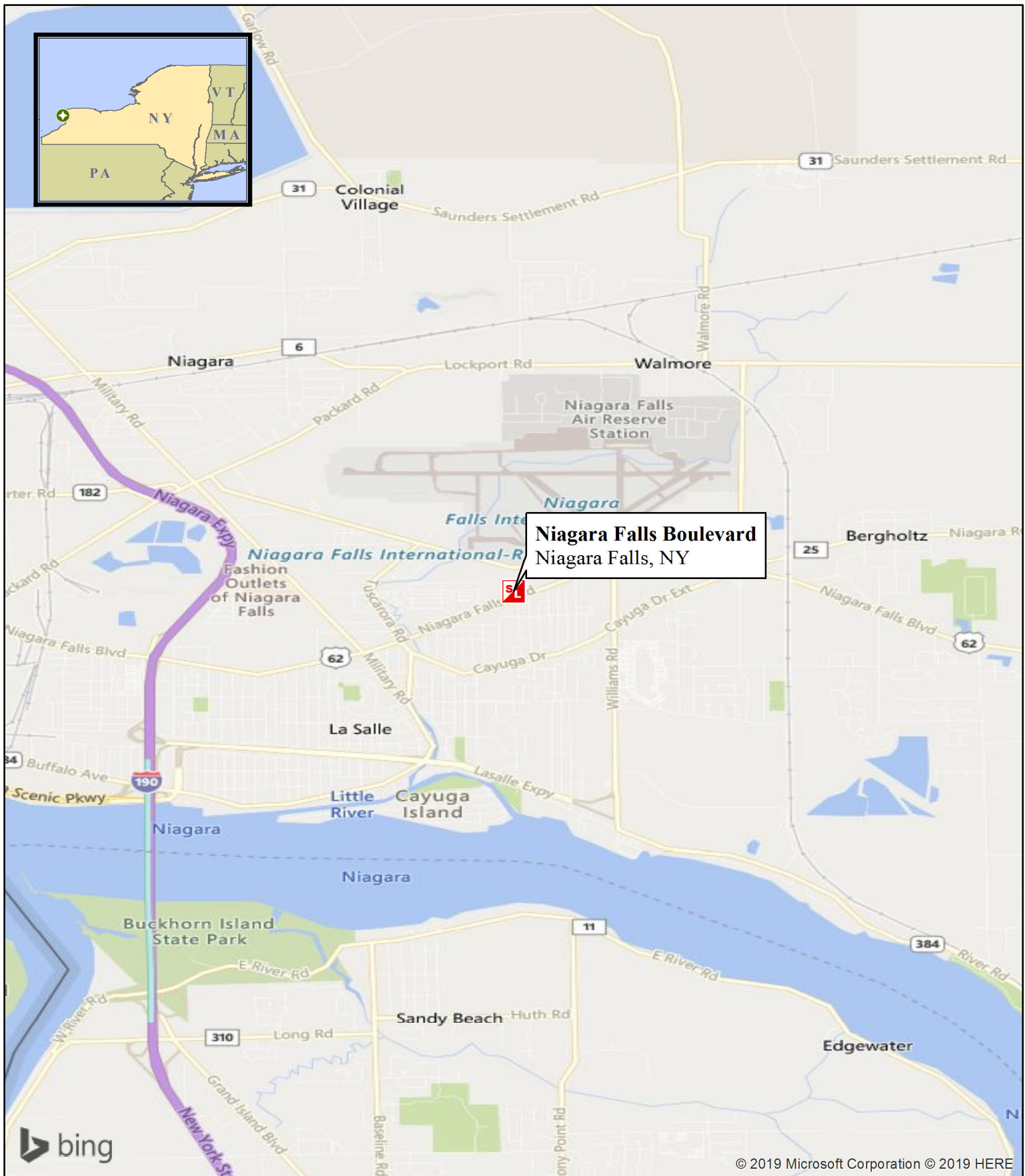
#### **Step 5 – Document data usability and draw conclusions:**

The DUA considered the final step in the data evaluation process. All data will be assessed for usability regardless of data evaluation/validation process implementation. Data usability goes beyond validation in that it evaluates the achievement of the DQOs based on the comparison of the project DQIs and site-specific QAPP with the obtained results. The results of the DUA, and particularly any changes to the DQOs necessitated by the data not meeting usability criteria, will be communicated in accordance with Worksheet 6.

The usability of the data as intended will be determined. Achievable DQOs, based on comparison with the Site DQIs, will be discussed. The performance of the sampling design will be assessed and limitations of the data use identified. The conceptual site model will be updated and conclusions documented. A DUA report (in the form of text/or table) will be prepared or a data usability summary will be included in the final report.

## **ATTACHMENT A**

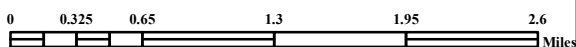
Figure 1: Site Location Map



## Legend



Site Location



**Weston Solutions, Inc.**  
Federal East Division

In Association With  
Eco-Risk; Avatar Environmental, LLC;  
Pro-West & Associates, Inc.;  
On-Site Environmental, Inc.;  
and Sovereign Consulting, Inc.

## Figure 1: Site Location Map

Niagara Falls Boulevard Site  
Niagara Falls, New York

U.S. ENVIRONMENTAL PROTECTION AGENCY  
SUPERFUND TECHNICAL ASSESSMENT  
& RESPONSE TEAM V  
CONTRACT # 68HE0319D0004

GIS ANALYST:	M. LANG
EPA OSC:	P. LISCHENKO
START V SPM:	B. NWOSU
CHARGE #:	40200.011.032.1033

DATE MODIFIED: 12/5/2019

## **ATTACHMENT B**

### Sampling SOPs

ERT/SERAS SOP # 2001 – *General Field Sampling Guidelines*

ERT/SERAS SOP # 2012 – *Soil Sampling*



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## GENERAL FIELD SAMPLING GUIDELINES

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Complete Rewrite: SOP #2001; Revision 1.0; 03/15/13; U.S. EPA Contract EP-W-09-031

SUPERCEDES: SOP #2001; Revision 0.0; 08/11/94; U.S. EPA Contract 68-C4-0022



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### 1.0 OBJECTIVE

The objective of this standard operating procedure (SOP) is to describe the general field sampling techniques and guidelines that will assist the Scientific Engineering Response and Analytical Services (SERAS) personnel in planning, choosing sampling strategies and sampling locations, and frequency of Quality Control (QC) samples for proper assessment of site characteristics. The ultimate goal is to ensure data quality during field collection activities.

### 2.0 APPLICABILITY

This SOP applies to the collection of aqueous and non-aqueous samples for subsequent laboratory analysis to determine the presence, type, and extent of contamination at a site.

### 3.0 DESCRIPTION

Representative sampling ensures that a sample or a group of samples accurately reflect the concentration of the contaminant at a given time and location. Depending on the contaminant of concern and matrix, several variables may affect the representativeness of the samples and subsequent measurements. Environmental variability due to non-uniform distribution of the pollutant due to topographic, meteorological and hydrogeological factors, changes in species, and dispersion of contaminants and flow rates contribute to uncertainties in sampling design.

Determining the sampling approach depends on what is known about the site from prior sampling (if any) and the site history, variation of the contaminant concentrations throughout a site, potential migration pathways, and human and environmental receptors. The objectives of an investigation determine the appropriate sampling design.

The frequency of sampling and the specific sample locations that are required must be defined in the site-specific Quality Assurance Project Plan (QAPP).

#### 3.1 Planning Stage

The objectives of an investigation are established and documented in the site-specific QAPP. The technical approach including the media/matrix to be sampled, sampling equipment to be used, sampling design and rationale, and SOPs or descriptions of the procedure to be implemented are included in the QAPP. Refer to the matrix-specific SOPs for sampling techniques which include the equipment required for sampling.

During the planning stage, the data quality objectives (DQOs) will be determined. In turn, the project's DQOs will determine the need for screening data or definitive data. Screening data supports an intermediate or preliminary decision but eventually is supported by definitive data before the project is complete (i.e., placement of monitor wells, estimation of extent of contamination). Definitive data is suitable for final decision making, has defined precision and accuracy requirements and is legally defensible (i.e., risk assessments, site closures).

#### 3.2. Sampling Design

Representative sampling approaches include judgmental, random, systematic grid, systematic simple random, stratified random and transect sampling. Sampling designs may be applied to soil,



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sediment and water; however, the random and systematic random approaches are not practical for sampling water systems, especially flowing water systems.

### 3.2.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations based on the professional judgment of the field team. This method is useful to locate and to identify potential sources of contamination. It may not be representative of the full site and is used to document worst case scenarios. For example, groundwater sampling points are typically chosen based on professional judgment, whether permanently installed wells or temporary well points.

### 3.2.2 Systematic Sampling

Systematic grid sampling involves the collection of samples at fixed intervals when the contamination is assumed to be randomly distributed. A random point is chosen as the origin for the placement of the grid. A grid is constructed over a site and samples are collected from the nodes (where the grid lines intersect). Depending on the number of samples that are required to be collected, the distance between the sampling locations can be adjusted. The representativeness of the sampling may be improved by shortening the distance between sample locations.

Systematic random sampling is used for estimating contaminant concentrations within grid cells. Instead of sampling at each node, a random location is chosen within each grid cell. The systematic grid and random sampling approaches are useful for delineating the extent of contamination, documenting the attainment of clean-up goals, and evaluating and determining treatment and disposal options.

Transect sampling involves one or more transect lines established across the site. Samples are collected at systematic intervals along the transect lines. The number of samples to be collected and the length of the transect line determines the spacing between the sampling points. This type of sampling design is useful for delineating the extent of contamination at a particular site, for documenting the attainment of clean-up goals, and for evaluating and determining treatment and disposal options.

### 3.2.3 Simple and Stratified Random Sampling

Statistical random sampling includes simple, stratified and systematic sampling. Simple random sampling is appropriate for estimating means and total concentrations, if the site or population does not contain a major trend or pattern of contamination. A statistician will generate the sampling locations based on sound statistical methods. Stratified random sampling is a useful tool for estimating average contaminant concentrations and total amounts of contaminants within specified strata and across the entire site. It is useful when a heterogeneous population or area can be broken down into regions with less variability within the boundaries of a stratum than between the strata. Additionally, strata can be defined based on the decisions that will be made. This type of sampling design uses historical information, known ecological and human receptors, soil type, fate and transport mechanism and other ecological factors to divide the sampling area into smaller regions or strata. Sampling locations are selected from each stratum using random sampling.



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The simple random sampling approach is applied when there are many sample locations and the concentrations are assumed to be homogeneous across a site with respect to the parameter(s) that are going to be analyzed or monitored for. The stratified random sampling approach is useful for sampling drums, evaluating and determining treatment and disposal options, and locating and identifying sources of contamination.

### 3.3 Sampling Techniques

Sampling is the selection of a representative portion of a larger population or body. The primary objective of all sampling activities is to characterize a site accurately in a way that the impact on human health and the environment can be evaluated appropriately.

#### 3.3.1 Sample Collection Techniques

Sample collection techniques may be either grab or composite. A grab sample is a discrete aliquot representative of a specific location at a given time and collected all at once from one location. The representativeness of such samples is defined by the nature of the materials that are sampled. Samples collected for volatile organic compounds (VOCs) are always grab samples and are never homogenized. Composite samples are non-discrete samples composed of more than one specific aliquot collected at selected sampling locations. Composite samples must be homogenized by mixing prior to putting the sample into containers. Composite samples can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. Incremental sampling conducted over a grid is a special case of composite sampling and is detailed in SOP #2019, *Incremental Soil Sampling*. Choice of collecting discrete or composite samples is based on project's DQOs.

#### 3.3.2 Homogenization

Mixing of soil and sediment samples is critical to obtain a representative sample. An adequate volume/weight of sample is collected and placed in a stainless steel or Teflon<sup>®</sup> container, and is thoroughly mixed using a spatula or spoon made of an inert material. Once the sample is thoroughly mixed the sample is placed into sample containers specific for an analysis. Avoid the use of equipment made of plastic or polyvinyl chloride (PVC) when sampling for organic compounds when the reporting limit (RL) is in the parts per billion (ppb) or parts per trillion (ppt) ranges. Refer to SERAS SOP #2012, *Soil Sampling*, for more details on homogenization.

#### 3.3.3 Filtration

In-line filters are used specifically for collecting groundwater samples for dissolved metals analysis and for filtering large volumes of turbid groundwater. Groundwater samples collected for VOCs are typically not filtered due to potential VOC losses. Filtering groundwater is performed to remove silt particulates from samples to prevent interference with the laboratory analysis. The filters used in groundwater sampling are either cartridge type filters inserted into a reusable housing, or are self-contained and disposable. Filter chambers are usually made of polypropylene housing an inert filtering material that removes particles larger than 0.45 micrometers ( $\mu\text{m}$ ). Refer to SERAS SOP



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#2007, *Groundwater Well Sampling* and SERAS SOP #2013, *Surface Water Sampling*, for more details on filtration techniques.

### 3.4 Quality Assurance /Quality Control Samples

QA/QC samples provide an evaluation of both the laboratory's and the field sampling team's performance. Including QA/QC samples in a sampling design allows for identifying and measuring sources of error potentially introduced from the time of sample container preparation through analysis. The most common QA/QC samples collected in the field are collocated field duplicates, field replicates, equipment blanks, field blanks and trip blanks. Extra volume/mass is collected for a matrix spike/matrix spike duplicate (MS/MSD) at a frequency of 5% (one in 20 samples). Spiking is performed in the laboratory. For additional information or other QA/QC samples pertinent to sample analysis, refer to SERAS SOP #2005, *Quality Assurance/Quality Control Samples*.

Collocated field duplicates may be collected based on site objectives and used to measure variability associated with the sampling process including sample heterogeneity, sampling methodology, and analytical procedures. Field replicates are field samples obtained from one location, homogenized, and divided into separate containers. This is useful for determining whether the sample has been homogenized properly. Equipment blanks (also known as rinsate blanks) are typically collected at a rate of one per day. The equipment blank is used to evaluate the relative cleanliness of non-dedicated equipment.

### 3.5 Sample Containers, Preservation, Storage and Holding Times

The amount of sample to be collected, the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix sampled and the analyses to be conducted. This information is provided in SERAS SOP #2003, *Sample Storage, Preservation, and Handling*. Field personnel need to be cognizant of any short holding times that warrant immediate shipment/transfer to the laboratory.

### 3.6 Documentation

Field conditions and site activities must be documented. Scribe will be used to document sample locations and generate chain of custody records. Other field measurements not typically entered into Scribe will be documented in a site-specific logbook or in a personal logbook. All sample documentation will be maintained in accordance with SERAS SOP #2002, *Sample Documentation* and SERAS SOP #4005, *Chain of Custody Procedures*.

## 4.0 RESPONSIBILITIES

### 4.1 SERAS Task Leaders

Task Leaders (TLs) are responsible for the overall management of the project. Task Leader responsibilities include ensuring that field personnel are well informed of the sampling requirements for a specific project and that SOP and QA/QC procedures stated in the site-specific QAPP are adhered to, issuing a Field Change Form that documents any changes to sampling activities after the QAPP has been approved and maintaining sample documentation.



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### 4.2 SERAS Field Personnel

Field personnel are responsible for reading the QAPP prior to site activities and performing sample collection activities as written. They are responsible for notifying the TL of deviations from sample collection protocols which occurred during the execution of sampling activities. Field staff will collect samples and prepare documentation in accordance with SERAS SOP #2002, *Sample Documentation*. In addition, field personnel are responsible for reading and conforming to the approved site-specific Health and Safety Plan (HASP).

### 4.3 SERAS Program Manager

The SERAS Program Manager is responsible for the overall technical and financial management of the project.

### 4.4 SERAS QA/QC Officer

The QA/QC Officer is responsible for reviewing this SOP and ensuring that the information in this SOP is updated on a timely basis. Compliance to this SOP may be monitored by either conducting a field audit or reviewing deliverables prepared by the SERAS TL.

### 4.5 Health and Safety (H&S) Officer

The H&S Officer is responsible for ensuring that a HASP has been written in conformance with SOP # 3012, *SERAS Health and Safety Guidelines for Field Activities* and approved prior to field activities. Additionally, the H&S Officer is responsible for ensuring that SERAS site personnel's H&S training is current as per SOP # 3006, *SERAS Field Certification Program* and that their medical monitoring is current as per *SERAS SOP #3004, SERAS Medical Monitoring Program*.



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\*These sections affected by Revision 1.0.

SUPERCEDES: SOP #2012; Revision 0.0; 2/18/00; U.S. EPA Contract 68-C99-223.



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## SOIL SAMPLING

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### 1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe procedures for the collection of representative surface soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push technology, or other mechanized equipment (except for a back-hoe). Sample depths typically extend up to 1-foot below ground surface. Analysis of soil samples may define the extent of contamination, determine whether concentrations of specific contaminants exceed established action levels, or if the concentrations of contaminants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with a final report.

Mention of trade names or commercial products does not constitute United States Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

### 2.0 METHOD SUMMARY

Surface soil samples can be used to investigate contaminants that are persistent in the near surface environment. Contaminants that are detected in the near surface environment may extend to considerable depths, may migrate to the groundwater, surface water, the atmosphere, or may enter biological systems.

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (discrete or composite), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and/or scoop. Sampling at greater depths may be performed using a hand auger, continuous-flight auger, trier, split-spoon sampler, or, if required, a backhoe.

### 3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Samples must be cooled and maintained at 4°C and protected from sunlight immediately upon collection to minimize any potential reaction. The amount of sample to be collected, proper sample container type and handling requirements are discussed in the Scientific, Engineering, Response Analytical Services (SERAS) SOP #2003, *Sample Storage, Preservation and Handling*.

### 4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary problems associated with soil sampling: 1) cross contamination of samples, and 2) improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, decontamination of sampling equipment is necessary. The guidelines for preventing, minimizing and limiting cross contamination of samples are discussed in the Environmental Response Team (ERT)/SERAS SOP #2006, *Sampling Equipment Decontamination*. Improper sample collection procedures can disturb the sample matrix, resulting in volatilization of contaminants, compaction of the sample, or inadequate homogenization of the samples (when required), resulting in variable, non-representative results.

### 5.0 EQUIPMENT/APPARATUS



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Soil sampling equipment includes the following:

- Site maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan (HASP)
- Traditional survey equipment or global positioning system (GPS)
- Tape measure
- Survey stakes or flags
- Camera and image collection media
- Stainless steel, plastic\*, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Site logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Plastic sheeting
- Spade or shovel
- Spatula(s)
- Scoop(s)
- Plastic\* or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoon sampler
- Soil core sampler
  - Tubes, points, drive head, drop hammer, puller jack and grip
- Photoionization detector (PID), Flame ionization detector (FID) and/or Respirable Aerosol Monitor (RAM)
  
- Backhoe (as required)
- En Core® samplers

\* Not used when sampling for semivolatile compounds.

### 6.0 REAGENTS

Decontamination solutions are specified in ERT/SERAS SOP #2006, *Sampling Equipment Decontamination*, and the site specific work plan.



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### 7.0 PROCEDURES

#### 7.1 Preparation

1. Determine the extent of the sampling effort, the analytes to be determined, the sampling methods to be employed, and the types and amounts of equipment and supplies required to accomplish the assignment.
2. Obtain the necessary sampling and air monitoring equipment.
3. Prepare schedules and coordinate with staff, client, and regulatory agencies, as appropriate.
4. Perform a general site reconnaissance survey prior to site entry in accordance with the site specific HASP.
5. Use stakes or flags to identify and mark all sampling locations. Specific site factors, including extent and nature of contamination, should be considered when selecting sample locations. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared prior to soil sampling; utility clearances must be confirmed before beginning intrusive work.
6. Pre-clean and decontaminate equipment in accordance with the site specific work plan, and ensure that it is in working order.

#### 7.2 Sample Collection

##### 7.2.1 Surface Soil Samples

The collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. The over-burden or over-lying surface material is removed to the required depth and a stainless steel or plastic scoop is used to collect the sample. Plastic utensils are not to be used when sampling for semivolatile compounds.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected by this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials must not be used.

The following procedure is used to collect surface soil samples:

1. If volatile organic compound (VOC) contamination is suspected, use a PID to monitor the sampler's breathing zone during soil sampling activities.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard sticks, rocks, vegetation and other debris from the sampling area.
3. Accumulate an adequate volume of soil, based on the type(s) of analyses to be performed, in



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a stainless, plastic or other appropriate container.

4. If volatile organic analysis is to be performed, immediately transfer the sample directly into an appropriate, labeled sample container with a stainless steel spoon, or equivalent, and secure the cap tightly to ensure that the volatile fraction is not compromised. Thoroughly mix the remainder of the soil to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly, or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, head, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger head. If additional sample volume is required, multiple grabs at the same depth are made. If a core sample is to be collected, the auger head is then replaced with a tube auger. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected.

Several types of augers are available; these include bucket or tube type, and continuous flight (screw) or post-hole augers. Bucket or tube type augers are better for direct sample recovery because a large volume of sample can be collected from a discrete area in a short period of time. When continuous flight or post-hole augers are used, the sample can be collected directly from the flights or from the borehole cuttings. The continuous flight or post-hole augers are satisfactory when a composite of the complete soil column is desired, but have limited utility for sample collection as they cannot be used to sample a discrete depth.

The following procedure is used for collecting soil samples with an auger:

1. Attach the auger head to an extension rod and attach the "T" handle.
2. Clear the area to be sampled of surface debris (e.g., twigs, rocks, litter). It may be advisable to remove a thin layer of surface soil for an area approximately six inches in radius around the sampling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents the accidental brushing of loose material back down the borehole when removing the auger or adding extension rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger head, proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a tube sampler. Install the



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proper cutting tip.

6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler and unscrew the extension rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the core or a discrete portion of the core into the appropriate labeled sample container using a clean, decontaminated stainless steel spoon. If required, homogenize the sample as described in Step 10.
10. If VOC analysis is to be performed, transfer the sample directly from the auger head into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger head to the drill assembly, and follow steps 3 through 11, making sure to decontaminate the auger head and tube sampler between samples.
12. Abandon the hole according to applicable state regulations.

### 7.2.3 Sampling at Depth with a Trier

The system consists of a trier and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a zero degree to forty-five degree ( $0^{\circ}$  to  $45^{\circ}$ ) angle from the soil surface plane. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If VOC analyses are required, transfer the sample directly from the trier into an appropriate, labeled sample container with a stainless steel spoon, or equivalent device and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; if composite samples are to be collected, place a sample from another sampling interval into the



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homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

### 7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18- or 24- inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should be performed in accordance with American Society for Testing and Materials (ASTM) D1586-99, "*Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of the barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler at a 90 degree (90°) angle to the sample material.
3. Using a well ring, drive the sampler. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain the sample.
5. Withdraw the sampler, and open it by unscrewing the bit and head, and then splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2- and 3.5-inch diameter tubes. A larger barrel (diameter and/or length) may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to the appropriately labeled sample container(s) and seal tightly. Place the remainder of the sample into a stainless steel, plastic, or appropriate homogenization container, and mix thoroughly to obtain a sample that is representative of the entire sampling interval. Then, either place the sample into the appropriate, labeled containers and secure the caps tightly, or if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.
7. Abandon the hole according to applicable state regulations.



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### 7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil when a detailed examination of stratigraphy and soil characteristics is required. The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is imperative to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific HASP and ensure that all safety precautions including appropriate monitoring equipment are installed as required.
3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by Occupational Safety and Health Administration (OSHA) regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If VOC analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations.

### 7.2.6 Sampling for VOCs in Soil Using an En Core® Sampler

An En Core® sampler is a single-use device designed to collect and transport samples to the laboratory. The En Core® sampler is made of an inert composite polymer and reduces the open-air handling of soil samples in the field and in the laboratory; thereby, minimizing losses of VOCs.

1. Assemble the coring body, plunger rod and T-handle according to the instructions provided with the En Core® sampler.



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2. Turn the T-handle with the T-up and the coring body down and push the sampler into the soil until the coring body is completely full. Remove the sampler from the soil. Wipe excess soil from the coring body exterior.
3. Cap the coring body while it is still on the T-handle. Push the cap over the flat area of the ridge. Be sure that the cap is seated properly to seal the sampler. Push and cap to lock arm in place.
4. Remove the capped sampler by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
5. Attach the label to the coring body cap, place in a plastic zippered bag, seal and put on ice.

Generally, three En Core® samplers are required for each sample location. These samplers are shipped to the laboratory where the cap is removed and the soil samples are preserved with methanol or sodium bisulfate.

### 8.0 CALCULATIONS

This section is not applicable to this SOP.

### 9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

2. All data must be documented in site logbooks or on field data sheets. At a minimum, the following data is recorded:

- Sampler's name and affiliation with project
- Sample number
- Sample location
- Sample depth
- Approximate volume of sample collected
- Type of analyses to be performed
- Sample description
- Date and time of sample collection
- Weather conditions at time of sampling
- Method of sample collection
- Sketch of sample location

2. All instrumentation must be operated in accordance with applicable SOPs and/or the manufacturer's operating instructions, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and must be documented.
3. The types of quality control (QC) samples to be collected in the field shall be documented in the site-specific Work Plan.



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### 10.0 DATA VALIDATION

This section is not applicable to this SOP.

### 11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific HASP.

### 12.0 REFERENCES

Mason, B.J. 1983. *Preparation of Soil Sampling Protocol: Technique and Strategies*. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1989. *Soil Sampling Quality Assurance User's Guide*. EPA-600/8-89-046.

U.S. Environmental Protection Agency. 1984. *Characterization of Hazardous Waste Sites - A Methods Manual: Volume II*. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, ER, B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

American Society for Testing and Materials. *Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils*. Method D 1586-99.

En Novative Technologies, Inc. 2001. *En Core® Sampler Sampling Procedures*. Web site access. March 13, 2001.



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### APPENDIX A

Figures

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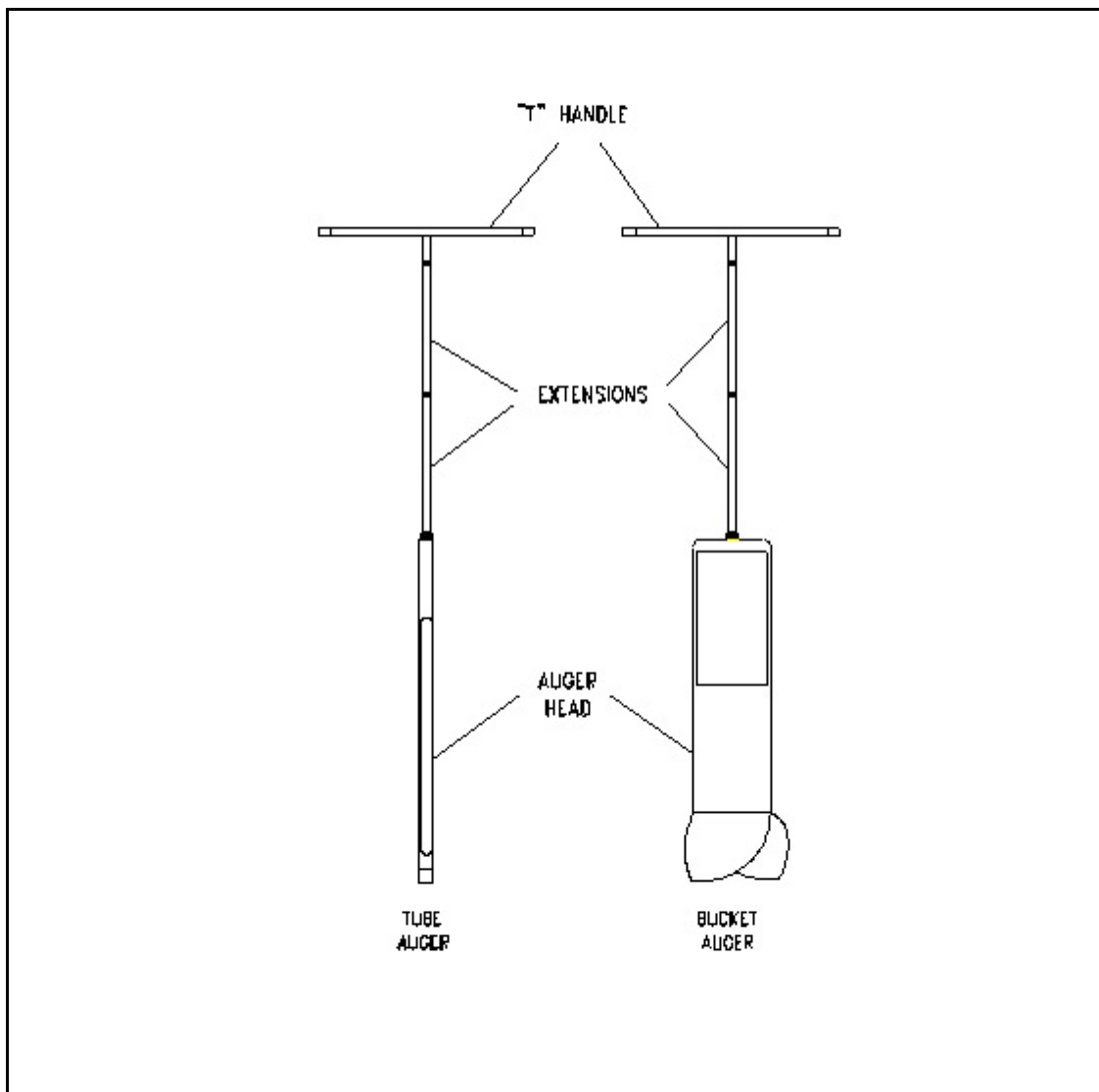
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FIGURE 1. Sampling Augers





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